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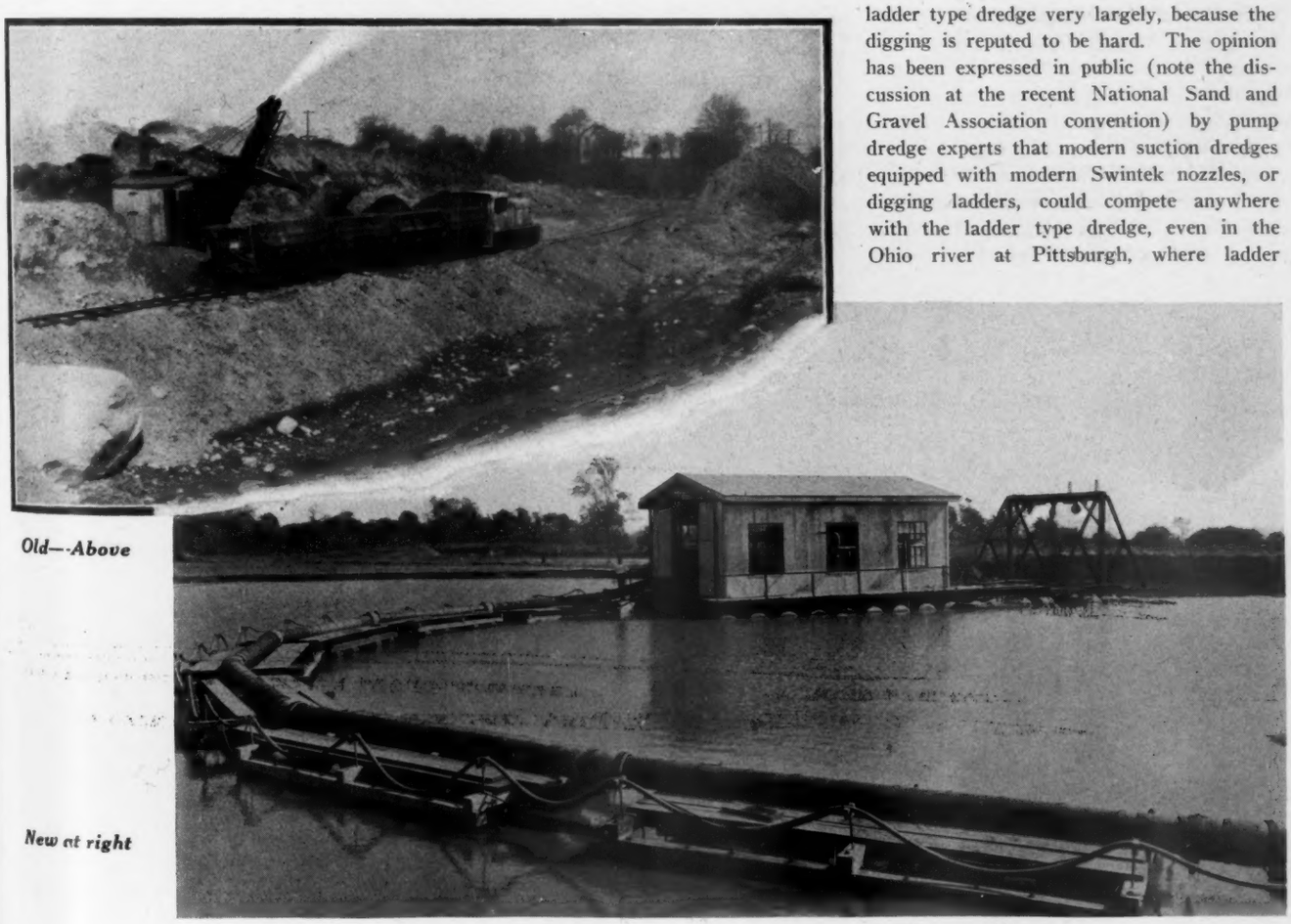
From Shovel to Dredge Excavation After Year's Operation

Bristol Sand and Gravel Co., Bristol, Penn., Follows Through with Original Plans for Efficient Operation

A GOOD EXAMPLE of a producer with courage to follow through plans for improving his operation, notwithstanding the prospect of a lessening demand and a general business depression is the Bristol Sand and Gravel Co., Bristol, Penn. This was a new company in 1929; its original operation was described in detail in ROCK PRODUCTS, May 10, 1930. At that time a 1-yd. shovel and industrial railway were used to excavate and transport the material to the plant, but the operators had expressed the intention to install a dredge as soon as the pit was sufficiently developed.

Other operators in this vicinity use the ladder type dredge very largely, because the digging is reputed to be hard. The opinion has been expressed in public (note the discussion at the recent National Sand and Gravel Association convention) by pump dredge experts that modern suction dredges equipped with modern Swintek nozzles, or digging ladders, could compete anywhere with the ladder type dredge, even in the Ohio river at Pittsburgh, where ladder

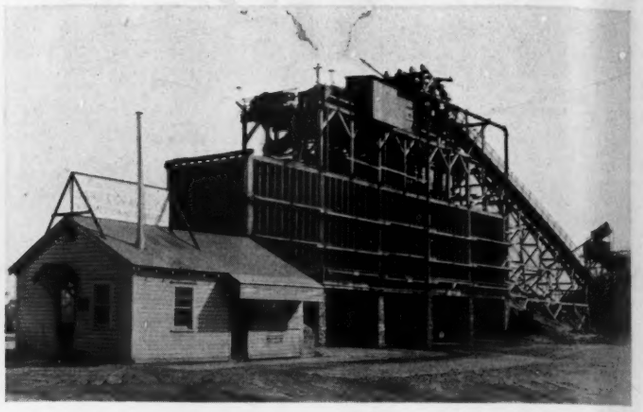


Old—Above

New at right

Development of sand and gravel pit from small shovel and car operation to pump dredging

New dredge with digging ladder



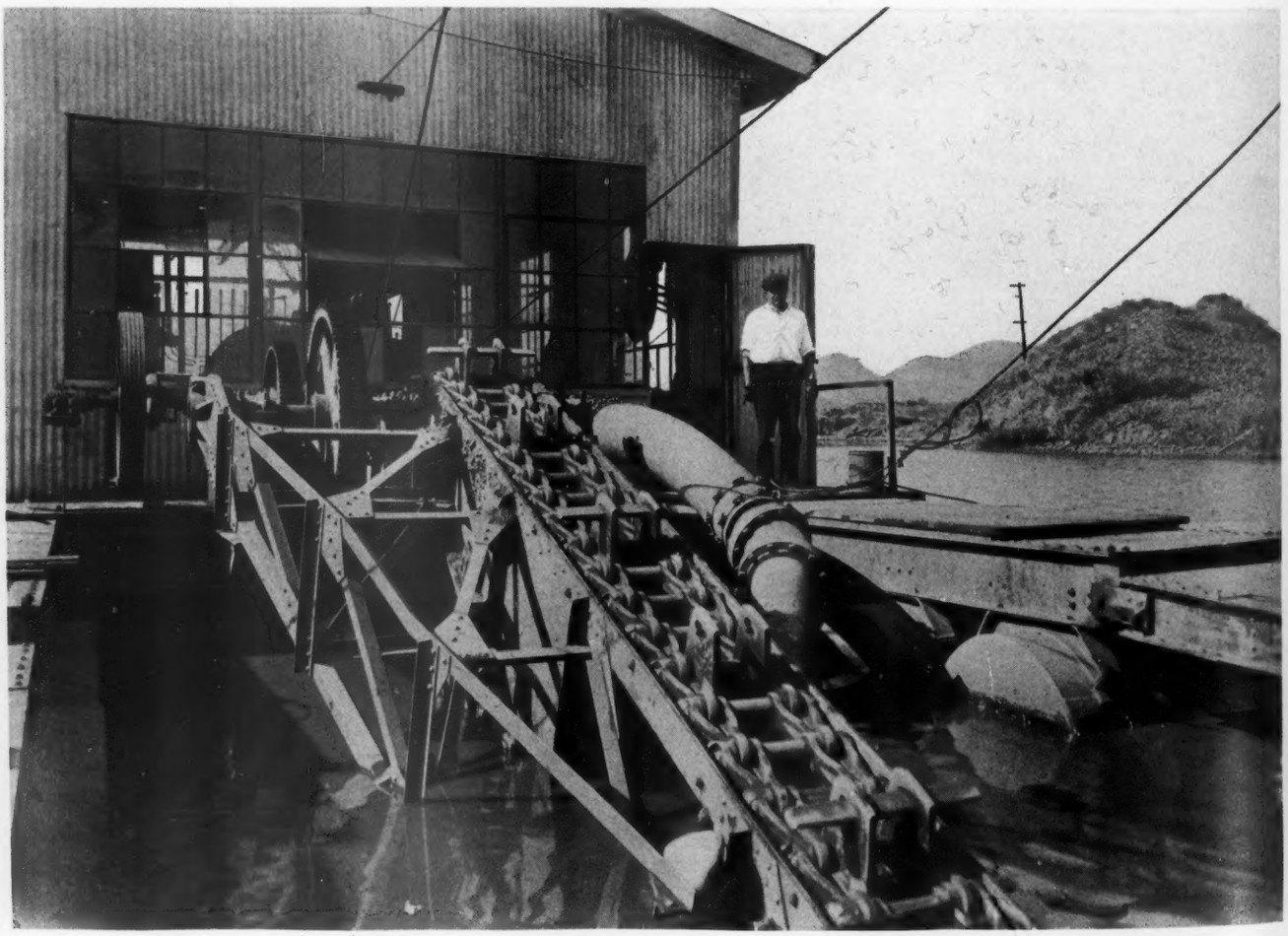
Sizing plant and loading bins

dredges are now used exclusively, and all previous experiences with suction dredges have failed.

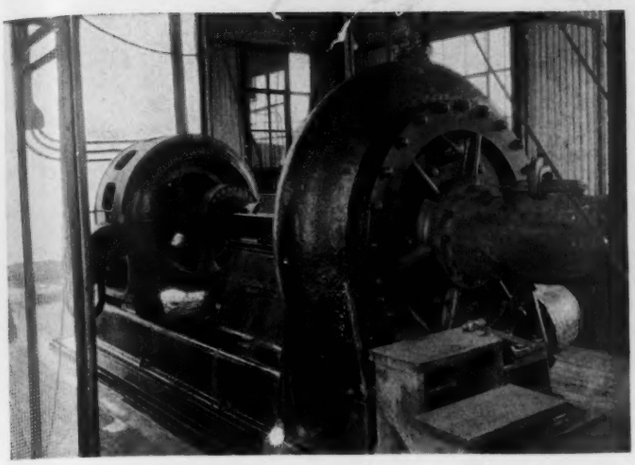
The Bristol Sand and Gravel Co. accepted the pump dredge experts' advice and installed a suction dredge of the most modern design in the summer of last year (1931), using a 12-in. Hetherington and Berner pump with some special features, as described later.

The hull of the dredge is of the pontoon type, with a series of cylindrical pontoons supporting the main body of the boat as well as the outboard section that supports the Eagle Iron Works Swintek traveling nozzle or ladder, making a rather novel form of construction. The dredge and superstructure is of structural steel and corrugated siding, and with a wood floor. In the fore part of the hull is mounted the three-drum American Hoist and Derrick Co. hoist that controls the 30-ft. digging ladder and the shore lines. The hoist is direct connected to a 20-hp. Allis-Chalmers 850-r.p.m. induction motor, and the Swintek cutter is driven by a 20-hp. motor of the same make through a Texrope drive. By using a drive of this type it is possible to set the motor back under the protection of the main building over the dredge, where it is protected from the weather. Otherwise, if direct connected, the motor would be either out in the open or have to have a separate housing. The cutters and chains are Amsco manganese steel.

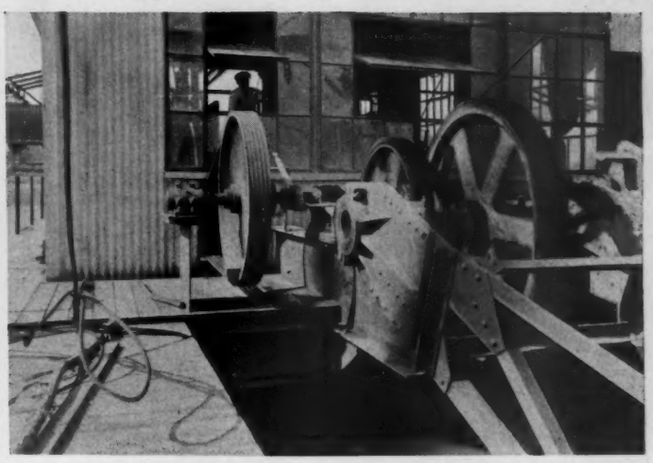
The 12-in. H. & B. dredge pump is direct connected to an Allis-Chalmers 300-hp., 440-volt, 3-phase, 60-cycle, induction motor. The center line of this unit is about parallel with the center line of the long axis of the dredge,



View of Swintek screen nozzle and suction line. Note digging bars on ladder



Motor-driven dredging pump



Drive end of digging ladder

with the pump towards the digging end of the dredge. By this arrangement the boat has the proper stability and floating balance. The pump has bearings of the sleeve type. The thrust is carried by a T-39 roller bearing manufactured by the Rollway Bearing Co. These bearings are similar in construction to the Kingsbury type and have proven highly satisfactory on this installation.

Three Westinghouse transformers, two on one side and one on the other, are placed alongside of the pump unit. Current is delivered to the dredge at 4000 volts and stepped down to 440 volts by these transformers. An I-beam, on which rides a 5-ton Yale spur gear hand-operated chain block, parallels the pump drive shaft, for handling replacements.

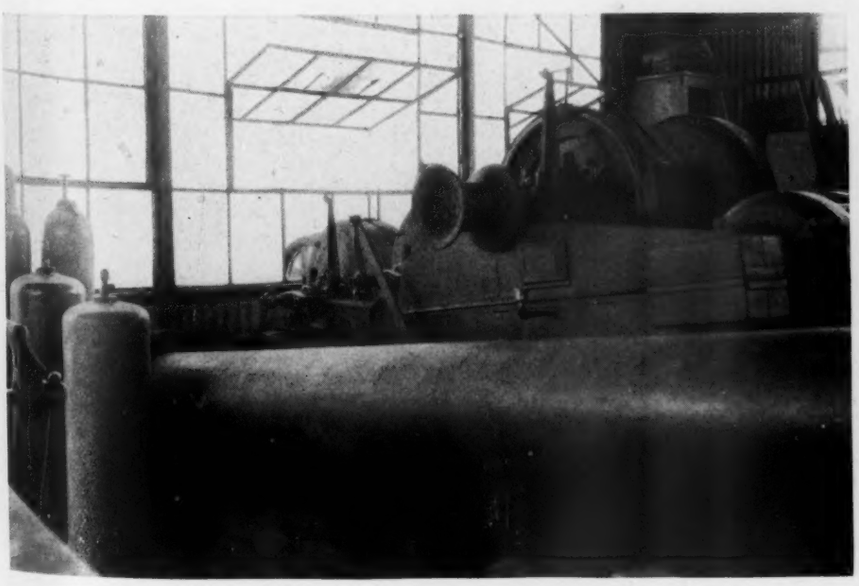
For priming, a 2½x2-in. Allis-Chalmers, Type SJH, 160-gal. per min., at 198-ft. head, centrifugal pump is direct connected to an Allis-Chalmers 15-hp., 3500-r.p.m., 440-volt, induction motor.

The dredge pump delivers to the plant through about 300 ft. of Naylor spiral pipe, using H. & B. "Elephant Trunk" rubber pipe sleeves.

The main body of the dredge hull is 29 ft. 6 in. wide and 58 ft. 6 in. long. The digging ladder support is an additional 30 ft. 6 in. long. The dredge was designed by the engineers of the Hetherington and Berner Co.

New Method Also Helps to Break Down Clay

The deposit is rather unusual for the district, having a higher percentage of clay than the deposits farther north, so at the time the plant was designed two 24-ft. McLanahan log washers were installed. These are still in service, but no doubt, owing to the change from method of excavation, the amount of clay sent to the logs has been somewhat reduced, as the sending of clay-bearing gravels through a centrifugal pump breaks down a considerable proportion of the clay present. There have been no changes in the plant since the description in ROCK PRODUCTS, May 10, 1930. W. S. Rockhill is plant superintendent.



Three-drum hoist used for raising and lowering the digging ladder and moving the dredge

Crushing and Grinding Efficiency

A PAPER presented at the annual meeting of the American Institute of Mining and Metallurgical Engineers in New York City, February, 1932, gave a survey of the study of the efficiency of ore crushing and grinding carried on by the U. S. Bureau of Mines during the past seven years. This was by John Gross, metallurgist, Bureau of Mines, Minneapolis, Minn.

Experiments on both laboratory and plant ball mills confirmed the Rittinger law in that the surface produced in crushing quartz has a linear relationship to the work input, but indicated that only a small part and not all of the total energy is used in producing new surfaces. The Rittinger constant, instead of being the actual sq. cm. of surface produced per ft. lb. of energy used, is then rather a figure depending upon the elastic constants of the material.

A method of measuring the surface of quartz particles by dissolution was devised but no suitable solvent has been found for other minerals. Correction factors for the density and shape of other mineral particles than quartz were given for use in determining sizing by elutriation.

The laboratory experiments on grinding efficiencies were made in a small boll mill, 12 in. in diam. by 16 in. long, equipped with a power recording device which showed the power input. Quartz of ¼ in. to 48-mesh size was used. The greatest amount of minus 200-mesh material was made at 50 r.p.m. or 60% of the critical speed and the best results were obtained at a pulp density of 40% by volume.

The efficiency dropped off rapidly when the ball size was less than three times the diameter of the largest feed and best results were with balls four times the size of the largest feed. The experiments did not indicate any relationship between work input per revolution and efficiency but did indicate that large ball charges gave better results. The possibilities in explosive crushing instead of by usual methods was suggested.

Canada Has Nearest to a 100% Quarry Enterprise

Canada Crushed Stone Co., Ltd., Not Only Makes Crushed Stone for All Commercial Purposes But Also Operates Famous Dimension Stone Quarry

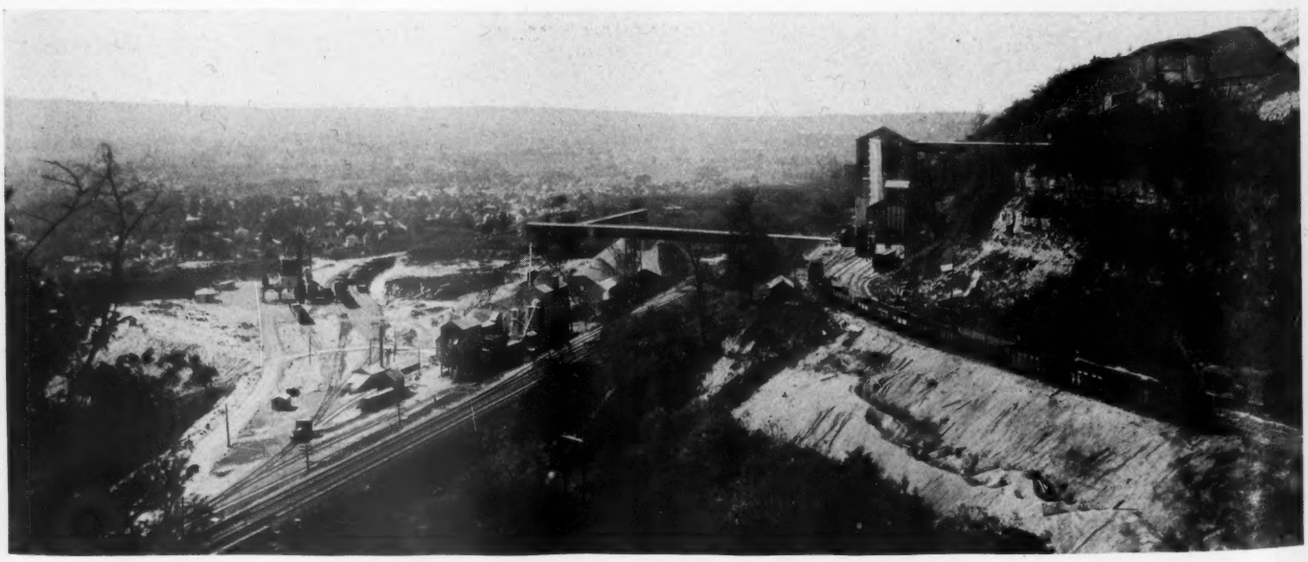
View of Dundas quarry

MANY former dimension stone quarries have been converted to crushed-stone operations; many more have been abandoned as concrete masonry has almost entirely replaced stone masonry for utilitarian purposes. Only for monumental and architectural uses has the dimension stone industry held on. So one would naturally expect to find crushed-stone quarry operators, who have had experience in the dimension stone business, busily engaged in blasting, shattering and reducing to fragments many a fine building stone. One would not expect to find an experienced crushed-stone operator, without experience in the dimension stone industry, putting new life and profit into a run-down dimension stone quarry.

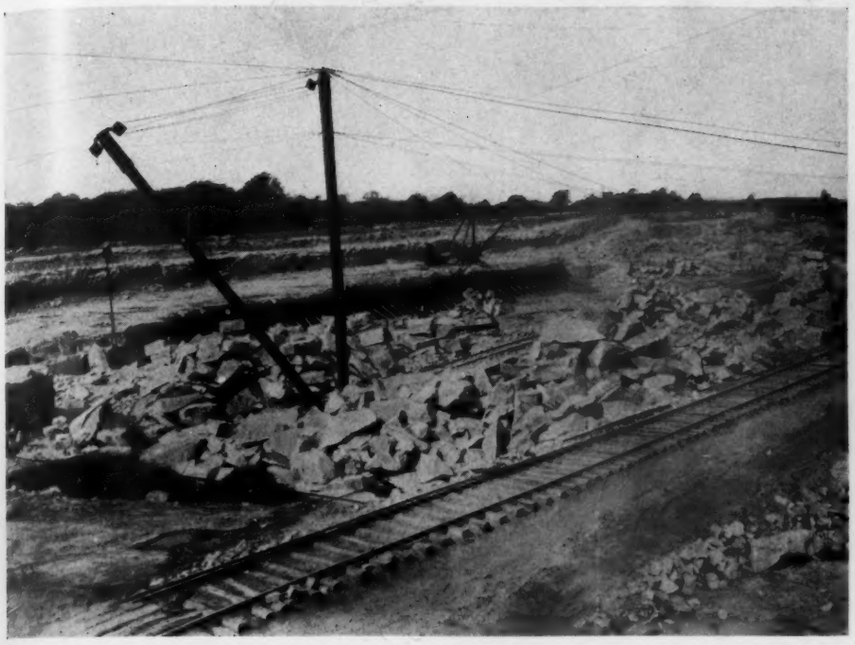
Yet that is what happened in Canada. Charles M. Doolittle, well known and well loved by the members of the National Crushed Stone Association, is the crushed-stone operator who now takes both pride and profit from his "Queenston Silver Grey Dolomite" quarry at Queenston, Ont. This quarry under his management has the unique honor of having supplied the only Canadian (or probably North American) stone used for a building in London, England—the new Ontario building on the famous Strand.

The Queenston quarry is one of the oldest in Canada. Before the advent of concrete the stone from this quarry was used in all the major engineering undertakings in the Niagara district. In 1837 it was used for the foundations of the International Bridge. Sixty-seven years later when the bridge foundations were rebuilt to meet demands for a heavier structure every original stone was reset, being perfectly sound. The Queenston stone was used for the original locks of the Welland Canal in 1846. Obviously it would make an excellent concrete aggregate.

But many famous buildings in Canada are faced with this stone, many monuments such as the Sir Isaac Brock monument at Brockton are built of it. Fortunately, sentiment and an appreciation of its artistic and architectural value prevented this quarry from being converted into a crushed-stone operation, but it remained for a crushed-stone



Dundas, Ontario, plant of the Canada Crushed Stone Co., Ltd.



Queenston quarry. Note how face is protected during cold weather

quarry operator to rejuvenate it and place it again in profitable operation.

Perhaps many a crushed-stone quarry operator in the United States is overlooking a similar opportunity. We recall, for example, that a similar stone in Wisconsin has found much favor in recent years for landscaping and building work, after the quarries that produce it had practically failed in competition for the concrete aggregate business.

The restoration of the Queenston quarry to a profit-making basis was no easy task. A Canadian contemporary, *Canadian Insurance*, describes the process as follows:

"The advancement of this Canadian product has not been accomplished without disappointment and discouragement. Owing to its hardness, Queenston must inevitably cost more in a building than the softer imported stones; the difference altogether being additional labor in cutting and carving. This additional cost is not prohibitive nor out of line with the intrinsic value, but it involves a certain amount of sales resistance.

"Canadian architects who, for a long period, were accustomed, of necessity, to specify imported stone for any major proposition, continued to do so. They cannot be condemned for this, as for years the domestic supply was undependable, owing to inadequate development of the industry in Canada. Poor equipment and questionable practice created a difference in cost that seemed excessive. Deliveries were so unreliable as to cause loss to contractors and disappointment to principals. In some instances quarries, in their efforts to make good their promises of delivery, shipped stone that should have been condemned. Fabricating plants were indifferent, and did not care to handle the product.

"Reorganized Queenston has had to combat and cope with this distressing inheritance. Prices of blocks were reduced 20%. Deliveries are prompt and the grading above criticism. Architects are awakening to the fact that domestic stone is worthy of consideration, and fabricating plants are successfully cutting and carving a product that they at one time condemned as being impractical."

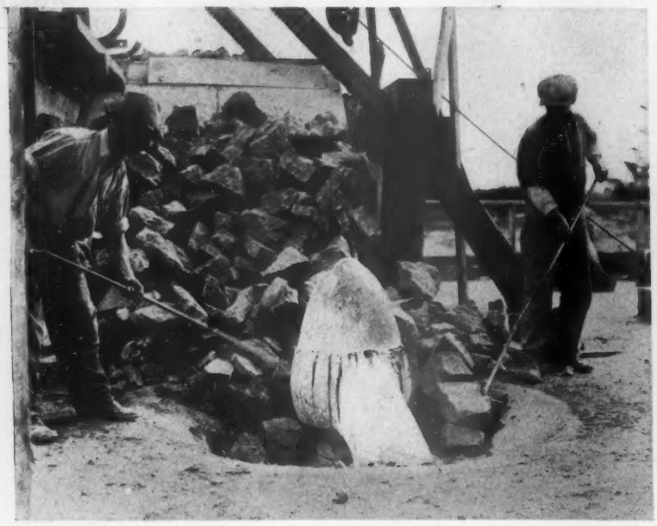
There are certain distinct advantages that a well-established crushed-stone operator has when embarking on a venture of this kind. Especially was this true with the Canada Crushed Stone Co., Ltd.

This company already had established prestige which had placed it among the leaders of Canadian basic industries, a position which commanded the respect of the Dominion government, of financial and religious organizations which have, in the past, been large purchasers of high quality decorative dimension stone. The company had a sales organization which was in touch with the buyers of crushed stone and commercial stone, and in many cases these same buyers could be interested in good dimension stone. Lastly the company had the financial means to carry out a quarry program that a less stable company would not be able to do. In the dimension stone industry it is sometimes many months from the time a piece of stone is quarried until it is placed on the job. The stone often has to be "cured," machined and hand-dressed before it is placed on the building, hence a quarry company must be prepared financially to carry on its part of the program for a few months, even a full year, before it can begin to realize a cash return on the finished stone.

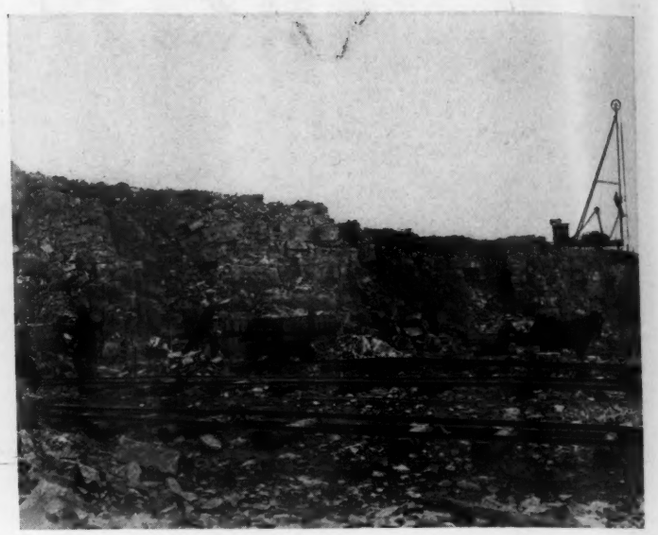
The deposits of dolomitic limestone that supply this dimension stone cover an area of over 200 acres, all of which has been core drilled and prospected to determine its full value. The deposit is covered with several feet of overburden which has to be stripped off.

There are three distinct layers of limestone in the deposit, the top one being referred to as "rubble," the middle as "buff stone," and the bottom layer as "blue stone." These layers range in thickness of from 4 to 6 ft. Blocks of stone weighing up to 21 tons each have been sliced off from the main ledge and each block was sound throughout, with no seams or flaws.

Puslinch crushing plant



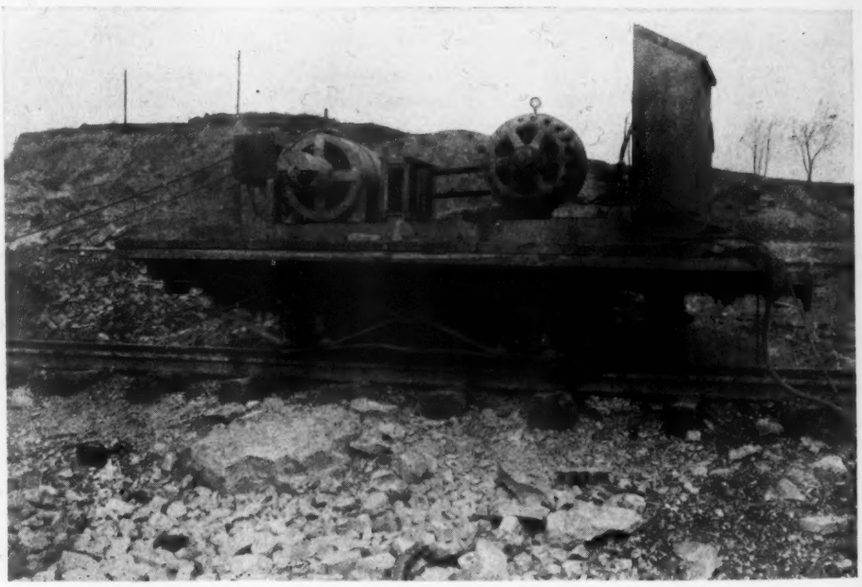
Primary crusher at Puslinch plant



View of Puslinch quarry

After the blocks have been quarried they are allowed to cure or age sufficiently long for the natural "sap" in the stone to evaporate. During this drying-out process the stone hardens some, giving a product that is harder than most dimension stones. This makes the stone more expensive to dress, but the additional investment necessary for dressing is amply repaid in its greatly increased life over most building stones. After the stone has cured sufficiently it is sawed into slabs by reciprocating gang saws, or turned down in lathes as a preliminary step in the fabrication of columns. The gang saws used are $\frac{3}{16}$-in. soft steel bands about 4 in. wide, without teeth but cutting by means of a stream of fine silica sand that is fed along with water to the saws, while in operation. A pure sharp silica sand is necessary, as impurities in the sand would discolor the stone.

During cold weather the face of the quarry is protected by a bed of straw, for it has been found that if the face is left exposed during the winter months uneven curing results, which imparts undesired characteristics to the stone. The accompanying illustration shows how the face is banked up to protect it from winter exposure. Once the stone has been properly cured and the internal strains allowed to relieve themselves in a natural way, there is no danger of unfavorable characteristics developing.

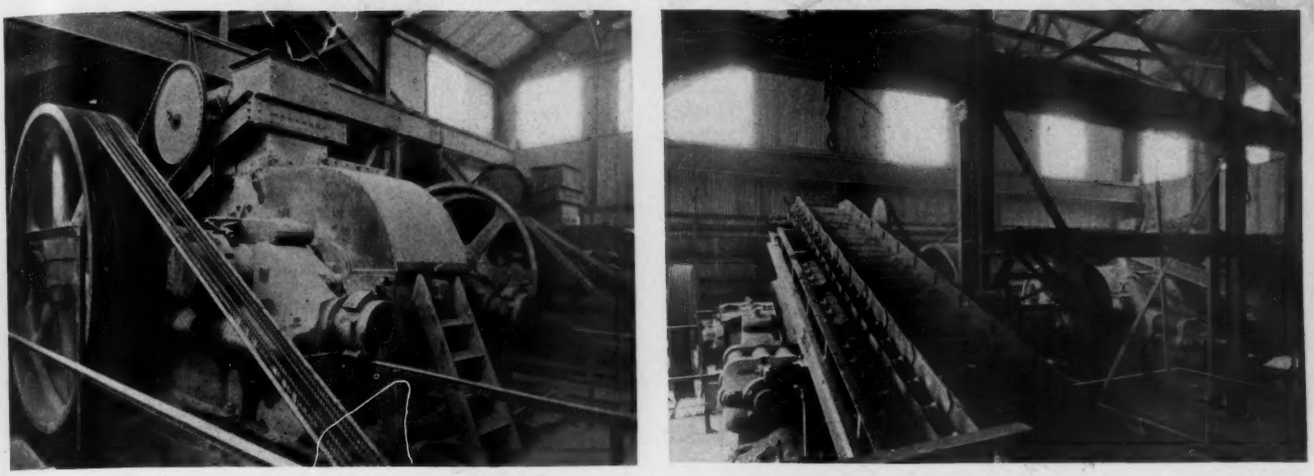


Welding outfit mounted on car

Stripping at the Queenston quarry

During the spring and summer months quarrying is carried on at a high productive level, and the material thus quarried is stored in the yard near the plant. No attempt is made at the plant to carve or otherwise fabricate the stone other than to saw it into slabs or to dress it down for pillars. Once the stone has been prepared it is loaded to cars by a 25-ton Morris crane that spans the yard.

Arthur Michie is vice-president and manager of Queenston Quarries, Ltd.



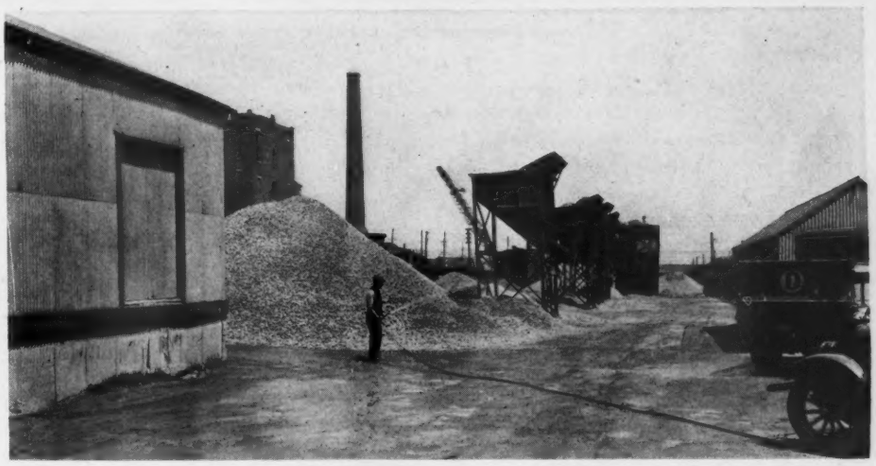
One of the two 72-in. recrushing rolls and pan conveyors serving them

Crushed-Stone Operations

The crushed-stone quarry operations of the Canada Crushed Stone Co., Ltd., have been described in these columns before, but to make the picture complete a brief résumé follows, which brings out some developments not previously described.

The main crushed-stone operation of the company is at Dundas, Ont., a few miles from Hamilton, Ont. Here a crushing plant is operated that has a capacity of 4500 tons of stone per day, not including screenings. Although the plant operates dry at present, washing, at least a rinse prior to loading, will probably be inaugurated shortly. The Dundas plant was completely destroyed by fire on April 29, 1922, and before the ashes had cooled a new plant was being designed which was constructed in record time. The new plant was completely described in the June 17, 1922, and August 11, 1923, issues of Rock Products.

The quarry covers a considerable area on the crest of a hill above the plant, the plant being a hillside operation. At present about 8 ft. of overburden is being handled for 40 to 60 ft. of dolomitic limestone. The amount of overburden is becoming heavier and the company is considering opening a new quarry about three miles from the present one, and probably will use electric motor haulage from the new quarry to the plant at Dundas. The plant being close to Niagara Falls, has a cheap source of electric power; hence electric haulage is favored.



Supply yard of Doolittle, Inc., at Hamilton, Ontario

For loading stone two Marion No. 92 steam shovels, mounted on crawler treads, and a No. 103 Bucyrus mounted on traction wheels were originally used. Last fall the company purchased a 120-B Bucyrus full-revolving electric shovel. The older shovels were provided with 3-yd. dippers. The new one has a 4-yd. dipper. An Austin, 1-yd. gasoline powered shovel mounted on crawlers is used for stripping. Stripping is disposed of by three 4-yd. General Motor trucks having pneumatic tires. Nine electric Cyclone 5⅝-in. churn drills are used for primary drilling and jackhammers for secondary work. Quarry haulage is by means of six saddle-tank 20-ton Vulcan steam locomotives. Western and Continental type 4-yd. standard gage quarry cars are used.

Air for secondary drilling is supplied by two Westinghouse air-cooled compressors mounted on trucks; one a 45-cu. ft. per min. and the other an 80 cu. ft. per min. machine. A Lincoln Electric welding outfit mounted on a standard gage industrial car was recently installed in the quarry (see accompanying illustration). This arrangement permits the welding outfit to be moved from place to place easily.

Hagersville crushing plant

Derricks and traveling crane used in handling dimension stone

Canadian explosives are used for primary and secondary shooting, 60% straight dynamite and 40% ammonia dynamite being favorites. Cordeau-Bickford fuse is used as a detonator.

The Dundas plant has a No. 21 Allis-Chalmers gyratory as a primary crusher and two sets of 72-in. by 30-in. Power and Mining Machinery Co.'s Garfield rolls as secondary crushers. The rolls are served by pan conveyors and are driven by two 250-hp. motors through rope drives.

Four 60-in. by 24-ft. rotary screens are used for primary screening. These screens have first, as an inner section, 12 ft. of 1¾-in. round holes and the balance are 2¾-in. round perforations. These rotaries have also a 6-ft. dust jacket with 1⅛-in. round perforations. Shaker screens, supplemented by Hum-mer screens, are used for the finer classifications. A 5½-ft. Symons cone is used as a recrusher.

For car loading a novel device has been installed under the loading bins, consisting of a Stephens-Adamson 30-in. pan conveyor supplemented by three short belt conveyors that act as feeders. These feeders deliver to a horizontal 36-in. belt under the bins, that in turn delivers to a car through a specially designed baffled chute to reduce segregation. The main belt runs at 400 ft. per min. and during its operation a car can be loaded in about 6 minutes.

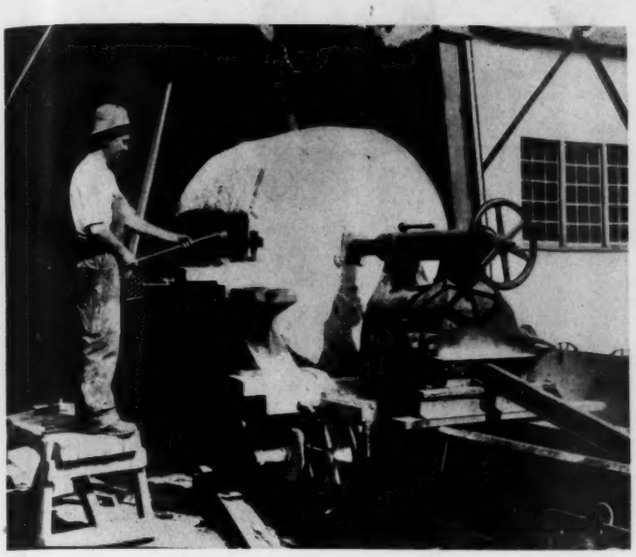
Excellent facilities are provided for ground storage of the crushed stone, consisting of a belt conveyor running in a steel gallery over the stockpiles. The gallery is 85 ft. high and is supported by fabricated steel legs that straddle the storage space. The storage space has a capacity of 50,000 tons.

Reclaiming is done by a 24-in. belt that delivers the crushed and sized stone to a bucket elevator serving the rescreening plant. Revolving screens are used in the rescreening plant from which the stone falls to bins for truck or car loading. Amiesite and Tarvia road-building materials are prepared in plants adjacent to the plant.

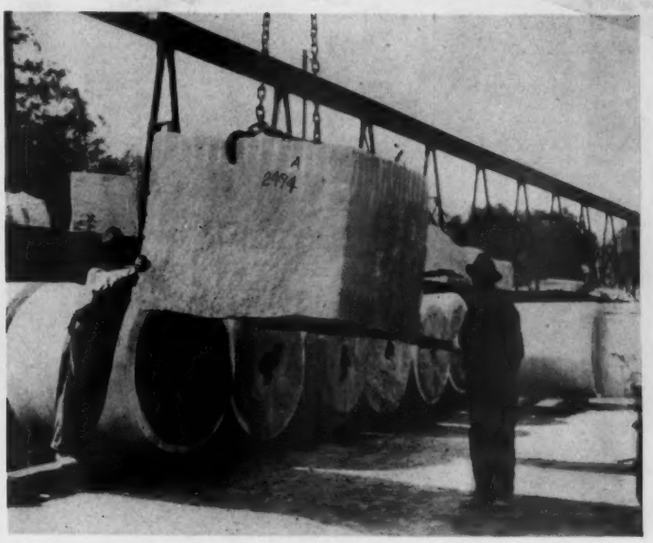
Hagersville Operation

This plant was rebuilt after being wrecked in 1926 by a Michigan Central railroad engine, and with additions and alterations since that time now has a capacity of 1500 tons of crushed limestone per day. The plant has a No. 7½ Gates and a No. 7½ McCully as primary breakers and a 3-ft. Symons cone,

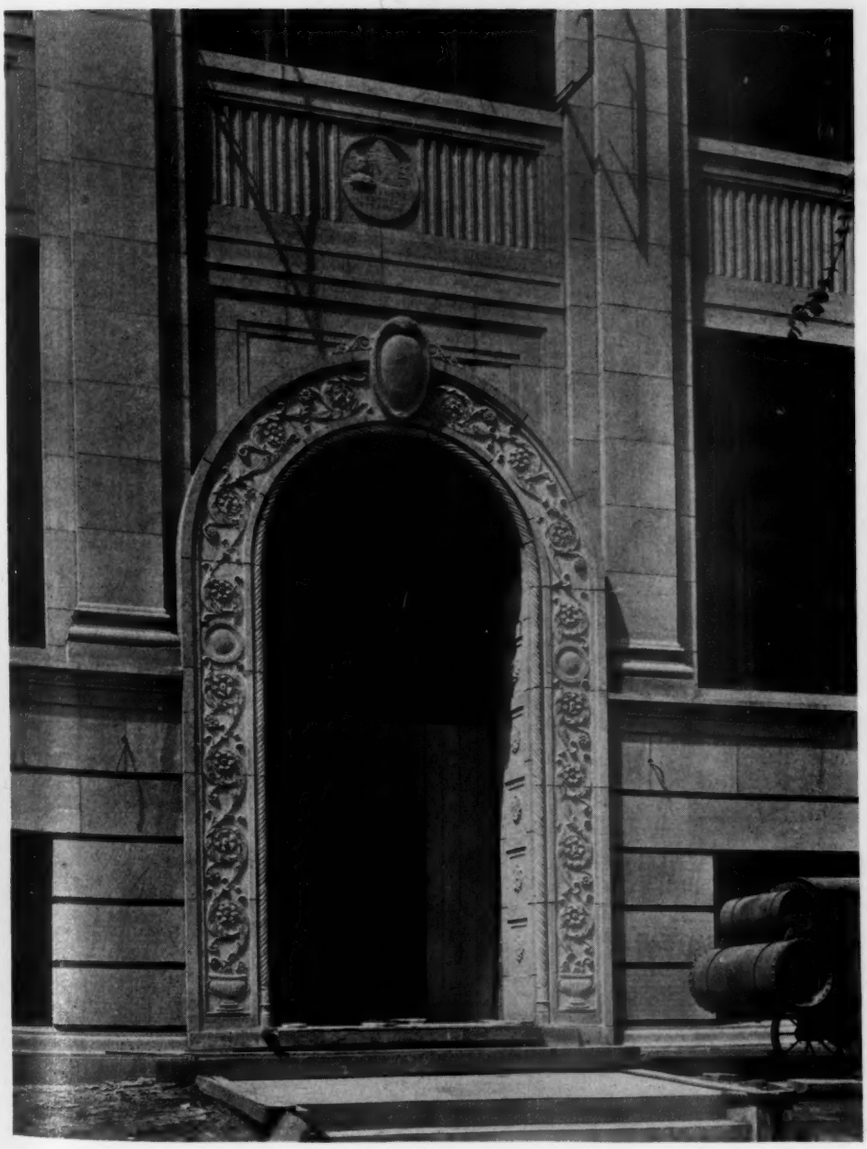
Ballast train of 48 cars leaving Dundas plant, 1926



Turning a large block



Handling dolomite block at Queenston plant



National Life Assurance Co. Building, Toronto, built of Queenston stone

a No. 5 Austin and a No. 5 McCully gyratory crusher as secondary breakers. Three rotary screens are used with Hum-mer vibrating screens for the finer sizes. The plant operates dry and is electric-driven throughout. Hand loading is done in the quarry. G. Gilbertson is superintendent of the Hagersville operation.

Puslinch Quarry

This quarry was taken over by the present owners in 1928 to supply dolomitic furnace linings to the steel mills at Hamilton. Some commercial aggregate and railroad ballast is also shipped from this quarry.

The stone is hand-loaded and the cars are discharged to a No. 5 McCully. A No. 4 McCully and a 6-in. by 18-in. Sawyer jaw crusher act as further reduction units. Two 36-in. double-decked Niagara vibrating screens are used for screening.

The novelty of the whole plant is the use of several second-hand automobile engines for driving the plant. Two old Buick engines and a 4-cylinder gas engine that was salvaged from a small launch are all belted to the single line shaft that serves the plant. Likewise, in the quarry the single Cyclone well drill uses an old Hudson automobile engine for motive power. The novel method of driving the plant was worked out by John Stephens, general superintendent of the Canada Crushed Stone Co., Ltd. The plant has a capacity of 400 tons in 10 hours. H. Hill is superintendent of the Puslinch operations.

The Canada Crushed Stone Co., Ltd., has offices in the Sun Life building at Hamilton, Ont.

Charles M. Doolittle is president; W. H. Lindsey, manager; Roy Watson, sales manager; R. G. L. Harstone, manager, Toronto office; John Stephens, general superintendent, and R. W. Cunningham, superintendent of the Dundas plant. The J. C. Buckbee Co., of Chicago, Ill., is consulting engineer for the Canada Crushed Stone Co., Ltd.

Method and Cost of Quarrying, Crushing and Grinding Limestone at the Security Quarry of the North American Cement Corporation, Security, Md.*

By Albert W. Cox†

THIS is one of a series of papers giving direct operating costs of crushing and grinding materials for cement manufacture. The plant is located at Security, about two miles from Hagerstown, Md.

The quarry and cement plant were put into operation in the summer of 1908 under the name of Maryland Portland Cement Co. In 1909 the company combined with the Berkeley Limestone Co. to form the Security Cement and Lime Co. In 1925 the company merged with the Helderberg Cement Co., with a cement plant at Howes Cave, N. Y., to form the North American Cement Corp. In 1926 the Acme Cement Corp., with a plant at Catskill, N. Y., joined the new corporation. The corporation now owns the three cement plants and one lime plant.

The stone is of the Conococheague formation. It is uniformly low in magnesia, and the calcium carbonate content varies up to 90%. The strike of the stone is about north 15 deg. east. The dip is nearly vertical, but its direction changes rather markedly at an overthrust near the west end of the present quarry working face (Fig. 1). The overburden varies from nothing to 15 ft., with an average depth of about 2 ft. It consists largely of smooth clay.

Prospecting and Sampling

The property was originally prospected about 1906. No deep drilling was done during the first or later stages of the prospecting. All samples taken were from the surface, but an effort was made to get unweathered rock, and allowances were made for changes which might reasonably be due to proximity to the surface. An area of about 100 acres was sampled in this way, the spacing of sampling points depending to some extent on the location of the outcrops. Samples were analyzed for lime, silica, iron, alumina, and magnesia.

The nearly vertical dip of the rock causes surface exposure of the strata, so that outcrops are numerous and representative. Drilling was not considered necessary or desirable, for drill samples might have been misleading due to their including only small sections of the strata. The sampling of surface-exposed rock was simpler and cheaper, and the results of such sampling when considered together with the geology of the district were entirely satisfactory. The cost of all the prospecting done previous to the purchase of the property was about $500. Additional investigations and surveys were made after the purchase of the property, but these merely served to confirm the results of the original examinations.

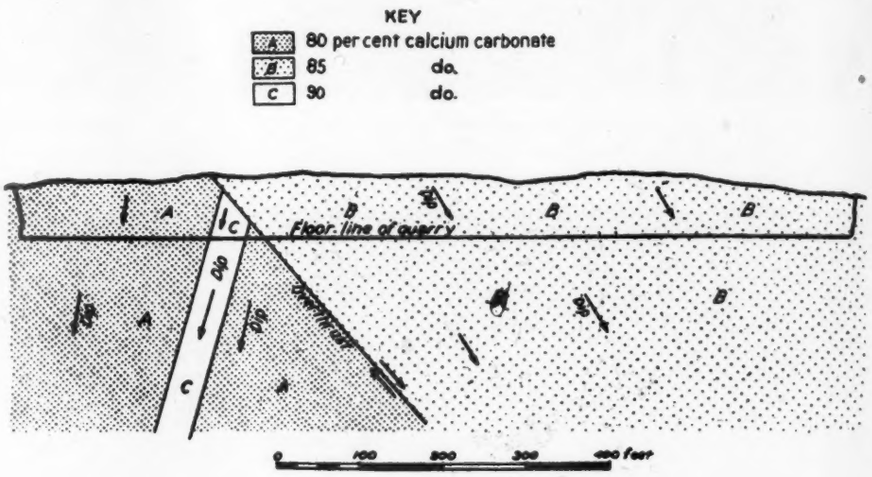


Fig. 1. Elevation of upper level of quarry

About three years ago prospecting of the land east of the present quarry was done by drilling the numerous outcrops with hand drills, and exploding small charges of dynamite to expose fresh stone. Nineteen points spaced pretty well over the 20 acres were thus sampled, the samples were analyzed in the plant laboratory and the results plotted on a map of the property. No deep drilling was done during this prospecting work.

The chemical make-up of the stone is important, and the drill muds from the blast holes are sampled and analyzed regularly. Samples are taken at 5-ft. intervals during the drilling of the holes, and the separate samples are analyzed for calcium carbonate, with occasional complete analyses of composite samples representing several holes.

The quarry as now worked consists of two levels. The upper level is a natural quarry formed by Antietam creek cutting into the flank of the limestone formation. The recently-opened lower level is an open pit started in the floor of the upper level and as yet is not sufficintly developed to furnish a large part of the total production.

Fig. 2 shows a plan of the upper and lower levels of the quarry, tracks, crushing and storage plant, etc. Fig. 1 shows an elevation of the present working face, indicating the change in the dip of the rock at the overthrust, etc. It does not show the east end of the quarry, where the working face swings around to a nearly north and south direction. The face here advances into the dip of the rock and runs parallel to the strike. The larger portion of the working face, running nearly east and west, is at right angles to the strike of rock.

The overburden is highly siliceous, a representative analysis of it being as follows: SiO_2, 64.0%; Al_2O_3, 19.4%; Fe_2O_3, 3.2%; CaO, 1.7%; MgO, 1.7%; ignition loss and undetermined, 10.0%. Silica, iron and alumina are necessary components of the cement raw mix, so that a certain amount of this overburden is used. But the distribution of overburden is not uniform, and as its quantity exceeds that needed some stripping is done.

Stripping is done at intervals of several months by a contractor who is paid on the

*Abstract of U. S. Bureau of Mines Information Circular 6554.

†One of the consulting engineers, U. S. Bureau of Mines and experimental engineer, North American Cement Corp.

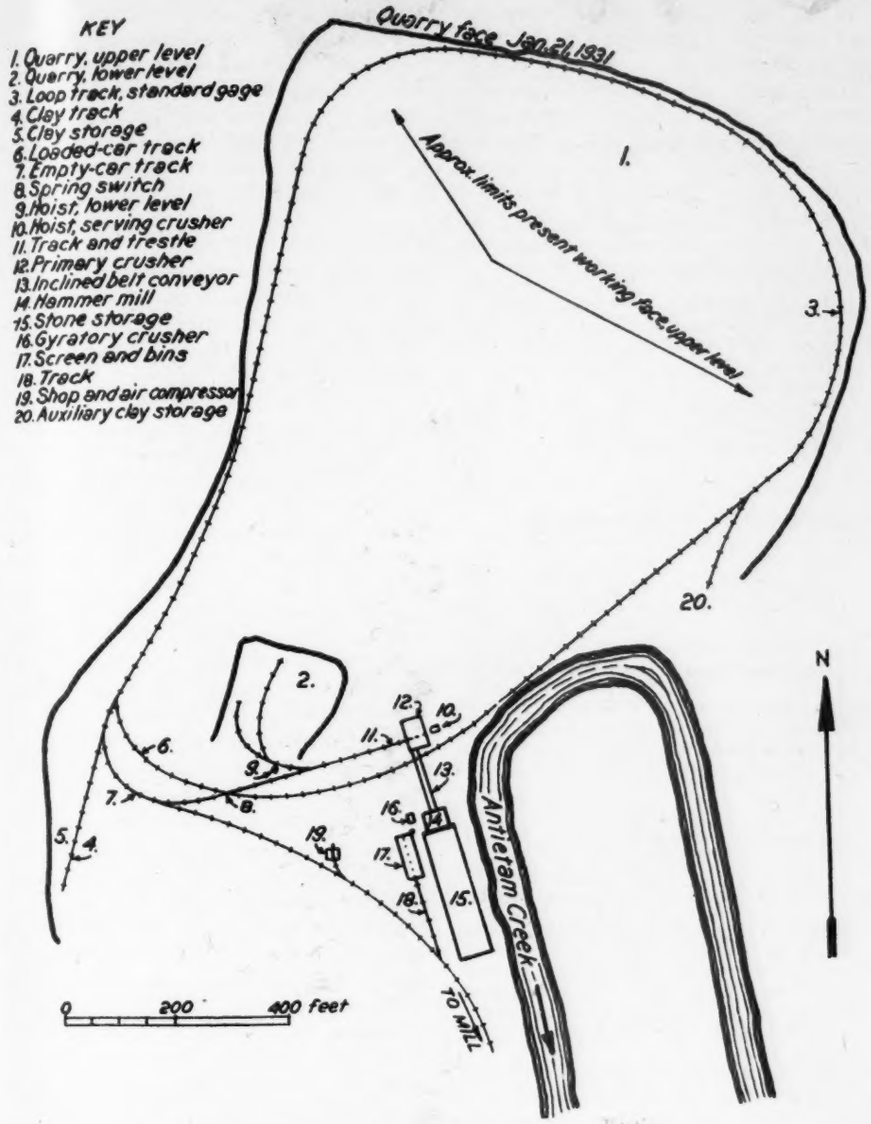


Fig. 2. Plan of quarry and crushing plant

basis of the number of trucks of material hauled. A gasoline-powered Keystone grader with ½-yd. scoop loads the overburden onto auto trucks which transport it about ½ mile to the clay storage, where it is dumped over the edge of the old quarry onto the quarry floor. The location of the clay storage on the floor of the upper-level quarry is shown by points 4 and 5 in Fig. 2. The clay is taken from storage as needed and put through the crushing and grinding system with the limestone.

Approximately 4700 tons of overburden was removed in 1930. The contractor was paid $2.50 per truck load or approximately 50c. a ton. The total overburden removed by stripping amounted to about 1½% of the total quarry output (stone plus used clay) for the year. All this stripping was done in the spring of the year.

Although most of the stone and clay quarried is used in the cement raw mix, a small percentage of clay-free stone is sent to a separate secondary crusher and screening plant to be sold as commercial stone. Of the total quarry output of 327,100 tons stone (including clay) in 1930, 17,000 tons of clay-free stone was sold in assorted sizes ranging from 2½-in. down to screenings. This tonnage represented between 5 and 6% of the total quarry output. The crushing and screening plant for handling commercial crushed stone operates intermittently as needed.

There is no waste from the quarry, except that in some of the previous major stripping jobs the clay (overburden) was wasted. In more recent stripping (that of last year), the clay was stored for future use. With the exception of the crushed stone sold for commercial uses, all the material passes through the several stages of reduction until it is of the high degree of fineness necessary for the cement raw mix.

The face of the upper quarry varies in height from 50 to 80 ft., and the present working face is about 1600 ft. long.

The face of the lower level is about 40 ft. high now, but this height will be increased to 50 ft. as the quarry is developed. The floor of this level is about 30 ft. below the surface of Antietam creek, so that it is necessary to pump drainage water from a sump back to the creek. This is done by a centrifugal pump driven by a 10-hp. electric motor. There is natural drainage from the upper-level quarry.

The output of stone plus clay from both levels varies from about 1000 to 1600 tons per day. The quarry operates in daylight only, nine hours a day, about 280 days a year.

Drilling

Three drills are used for primary drilling of blast holes. One Loomis "Clipper" drill is powered by a 15-hp. electric motor, using 440-volt alternating current; two Keystone drills are powered by steam. They are belt-driven and are of the traction type. The electric drill is liked best, for its ease of starting and for the convenience of power supply. Comparative operating costs for the different drills are not available, nor are figures for the total feet drilled by the individual machines. However, the following figures are indicative of the drilling experience here:

Total feet drilled, 1930 (primary blasting only)	9,300
Total quarry output, 1930 (tons stone plus clay)	327,100
Total feet drlled per 1000 tons quarry output	28.4
Total tons per foot of hole drilled	3.52

These figures relate to drilling for primary blasting only and do not include that done for secondary blasting. The drilling speed of the blast-hole drills is about 3 ft. per hr. of total time per machine. The bits used by the blast-hole drills are of steel, and are 6 in. in diameter by 4 ft. long. They are sharpened in the quarry shop by a Gill compressed-air bit sharpener after drilling 40 or 50 ft. During the primary drilling, pieces of iron pipe 7 in. in diameter by 4 to 6 ft. long are used to case through the overburden. The pipe is left in the hole until the hole is loaded when it is pulled out and saved for future use.

The holes are placed 25 ft. back from the quarry face and are spaced 15 ft. apart; they extend to a point about 5 ft. below the quarry floor and are from 55 to 85 ft. deep. This spacing was found to give the best results after experimenting during the course of two or three years.

Drilling operations are made difficult by the number of mud seams encountered, these seams being numerous near the east end of the quarry face. Clay pockets have at times been so troublesome that concrete was poured into the hole to prevent the sides from falling in. Caves are rare, but one large one was encountered near the middle of the working face of the upper level; it was necessary to bridge over this cave with wooden beams when moving the shovel over it. The stone toward the west end of the

quarry is lower in calcium carbonate and somewhat harder, which slows up drilling to some extent. On the whole, however, the most trouble is encountered with the mud seams near the east end of the quarry. The percentage of holes lost is probably not over 1 or 2%.

Secondary drilling is done by one tripod drill and five jackhamer drills, using compressed air at a pressure of 100 lb. per sq. in. Air is supplied by a Worthington 13x14 in. air compressor driven by a 100-hp. electric motor and located in the quarry shop. The 3-in. pipe line near the compressor is buried, but the 1-in. pipe lines distributing air to drills are laid on the ground. The tripod drill uses steel 1⅛-in. in diam. by 7 to 20 ft. long, and the jackhamers use steel ⅞-in. in diam. by 2 to 20 ft. long.

Blasting

The arrangement of dynamite in the holes is as follows: 50 to 150 lb. of 75% quarry gelatin at the bottom of each hole; 200 to 250 lb. of 60% quarry gelatin next; 100 to 200 lb. of 40% Red Cross ammonia dynamite next, and 20 to 25 ft. of stone screenings on top. The dynamite is stopped 20 to 25 ft. from the top of all holes. Most holes are loaded solidly with dynamite up to the stone screenings, but in some holes where the stone is expected to break easily the dynamite charges are alternated with 5 to 12 ft. of stone screenings.

Covered cordeau is used in the holes and for the header; no plain cordeau is used. The cordeau is fastened to the first stick of quarry gelatin put in the hole. A No. 6 detonator is used at one end of the header to detonate the cordeau. The 2 ft. of fuse attached to the detonator is lighted with a match. No battery is used for blasting

A powder crew of six men loads the holes at the rate of about 20 minutes per hole. The crew divides the work as follows: 2 men haul dynamite, 1 opens boxes, 2 load dynamite into holes and 1 pours stone screenings into holes. The stone screenings used in the holes are not tamped down. Twenty holes are blasted at one time, and the stone obtained is sufficient to last from 60 to 90 days. The normal fragmentation obtained results in stones of 2 to 3 tons and smaller, but an occasional stone of 20 tons or more is obtained.

The track along the quarry face and for a safe distance back along the loop is removed before primary blasts are set off. The track is removed by hand labor, the rails and ties being piled on a small flat car which is moved by hand from the danger zone. After the blast and some preliminary cleaning up the track is replaced.

In secondary blasting, the larger blocks of stone are drilled but the smaller pieces are mud-capped. The secondary blasting is probably about equally divided between these two types of shots. Ammonia dynamite of 40% strength in 1¼- by 8-in. sticks is used, with Clover-brand fuse and No. 6 detonators, the length of the fuse being 2 ft. and its burning time 1 min. and 40 sec., a rate of 50 sec. per foot.

Two men work full time on primary drilling, and three to four men (the blaster part time) on secondary drilling. The men on primary drilling are paid by the foot drilled and those on secondary drilling by the hour.

The following figures for 1930 show the grades and quantities of dynamite used:

Total stone quarried (including 1 to 2% of overburden), tons	327,100
Dynamite used for primary blasting (sticks 4 and 4½ in. diam. by 16 in. long):	
75% quarry gelatin, lb.	6,600
60% quarry gelatin, lb.	24,500
40% Red Cross extra, lb.	22,200
Total lb.	53,300
Dynamite used for secondary blasting (sticks 1¼ in. diam by 8 in. long):	
40% Red Cross extra, lb.	49,800
40% straight, lb.	22,700
Extra D, lb.	1,900
Total lb.	74,400
Total dynamite used, all blasting, lb.	127,700
Tons of stone per pound of dynamite:	
Primary blasting	6.14
Secondary blasting	4.40
All blasting	2.56

Loading

All stone and clay (from storage) is loaded by shovels, the shovel equipment being as follows:

1 Marion "75" steam shovel, 100-ton, railroad-type, half-revolving, 3½-yd. dipper.
1 Marion "60" steam shovel, 80-ton, railroad-type, half-revolving, 2½-yd. dipper.
1 Marion "70-E" electric shovel, 110-ton, caterpillar-type, half-revolving, 3¼-yd. dipper.
1 Thew "A-1" steam shovel, 22-ton, traction-type, full-revolving, ⅝-yd. dipper.

The two Marion steam shovels are now serving the upper quarry level. The electric shovel is on the lower level. The Thew steam shovel handles clay from the clay storage.

The electric shovel is liked best because of performance, convenience of power supply and ease of movement with its caterpillar treads. Electric current is brought to it by a 4-conductor rubber-covered cable 500 ft. long, which is laid along the ground and covered with pieces of old conveyor belt. The shovel operates on 2300-volt alternating current. The two Marion steam shovels each require a fireman, an engineer and a craneman, whereas the electric shovel requires only an engineer and a craneman. The Thew steam shovel, because of the intermittent character of its work at the clay storage, uses only one man.

It is difficult to compare the loading speeds of the shovels, for they are at times handicapped by the necessity for blending the stone. In order to obtain thorough blending of stone of different chemical characteristics, the relative number of cars loaded by the different shovels is varied. Thus, the schedule of loading at a certain time may be four cars from one shovel, to one car from another, to three cars from the third. At the same time the shovel serving the clay storage pile might be loading clay for storage in cars until used. This schedule would be maintained until the blending requirements dictated another schedule.

Haulage

All tracks in the quarry and throughout the cement plant are standard gage. Sixty-pound rails are used in the quarry and 85 lb. rails in the track between the quarry stone storage and the cement mill. The quarry track is for the most part about level, but there is a sharp incline, of about 23% grade, from the lower level to the upper level; and a second one, of about 13% grade, from the upper level to the dumping platform at the primary crusher. A single-drum hoist served by an 82-hp. motor pulls one car at a time from the lower level; and a Flory hoist served by a 125-hp. motor pulls one car at a time to the crusher for dumping. The maximum grade of the track between the quarry stone storage and the cement mill is about 5%, with an average of about 2%.

One Vulcan saddle-tank steam locomotive of 26 tons serves the quarry, and a second identical locomotive transfers stone from the quarry stone storage to the cement mill.

In picking up loads and placing empty cars on the upper quarry level, the locomotive reverses its direction of travel on alternate trips. Each time it pulls the empties and pushes the loads. The tracks are equipped with spring switches, so that the switching is done automatically. There is no time lost in waiting for empty cars at the shovels (other than that due to the schedule of loading).

The quarry-car equipment consists of 22 special Earnshaw-type, 7-yd., 10-ton, side-dump cars. With the loop arrangement of the track, the dumping side of the cars is always on the proper side when the cars are placed at the crusher. Because the number of cars loaded by the different shovels varies due to the loading schedule, the number of cars per train varies from 5 to 8. The length of haul from the most distant point of the working face on the upper level to the primary crusher is about ½ mile, with an average haul of 2000 ft.

Crushing

The stone (plus clay) passes successively through a jaw crusher, a hammer mill, rotary dryers, a second hammer mill and finally through a Hardinge air-swept mill and Fuller mills. The jaw crusher, the first hammer mill and the rotary dryers handle, in turn, the full tonnage of material; the second hammer mill is served by a Hum-mer screen which by-passes about one-fourth of the total tonnage, sending three-fourths of it to the hammer mill; the material then goes to the Hardinge mill and 14 Fuller mills, each mill receiving a portion of the total

tonnage, and delivering material of the required fineness.

Before the material reaches the grinding mills a final correction of chemical composition is made by adding cinders. The cinders are rich in silica, iron and alumina and are used to increase these constituents of the cement raw mix. They are purchased from the railroad companies, are crushed in a small hammer mill, dried in a rotary dryer and meet the stone (plus clay) at the proportioning scales ahead of the grinding mills. The percentage of cinders averages about 6, so that the total tonnage handled by the grinding mills is about 6% greater than that handled by the crusher and hammer mills.

A flow sheet of the crusher, hammer mills, etc., is shown in Fig. 3. The jaw-crusher and hammer-mill output averages 135 tons an hour including time running empty; their capacity output is 200 tons an hour. The Fuller-Lehigh mill has an output of 3.4 tons per mill-hour when receiving minus ½-in. feed; with present practice the feed is minus ¼-in.

The primary crusher is located in the quarry, the pit beneath it extending several feet below the floor of the upper-level quarry, but the dumping platform at the crusher is about 12 ft. above the level of the quarry floor. The crusher is a 48 by 60 in. Allis-Chalmers jaw crusher, belt-driven at 156 r.p.m. by a 200-hp. induction motor. Quarry cars are placed for dumping, one at a time, by an electric hoist, and a second single-drum hoist driven from the crusher motor is used to dump them into the crusher.

The crusher receives stone in sizes ranging from 4 ft. down, and discharges stone ranging from 9-in. down. One crusher attendant places the cars for dumping, dumps them, aids in releasing large stones stuck in the crusher, etc. In dumping cars he tilts the car gradually, allowing the stone to feed into the crusher at the proper rate. A second attendant feeds the crusher (loosening large stone), oils, cleans up, etc.

The stone discharges from the jaw crusher on to a belt conveyor, on which it is carried to a gyratory crusher (for commercial crushed stone only) or to a hammer mill (for the cement raw mix). The belt is rubber-covered, 48 in wide, 120 ft. between centers, inclined 17 deg. and travels at the rate of 230 ft. per min.

The gyratory crusher is a No. 7½ Austin and discharges stone in sizes from 2½-in. down. It delivers to a 24-in. bucket elevator 50 ft. high, which in turn delivers to a revolving screen. The elevator and screen are driven by a 60-hp. induction motor. The screen, which is over the stone bins, is 5 ft. in diam. by 57 ft. long, and is made up of sections with punched holes of ½-, 1-, 2- and 3-in. diam. The stone sorted by this screen falls into five rectangular steel bins of about 100 tons capacity each, whence it is drawn into automobile trucks or railroad cars for shipment. Clay-free stone only is put through this part of the crushing system and all the material handled here is sold for commercial use, none of it going to the cement raw mix. The tonnage so disposed of represents about 6% of the total quarry output.

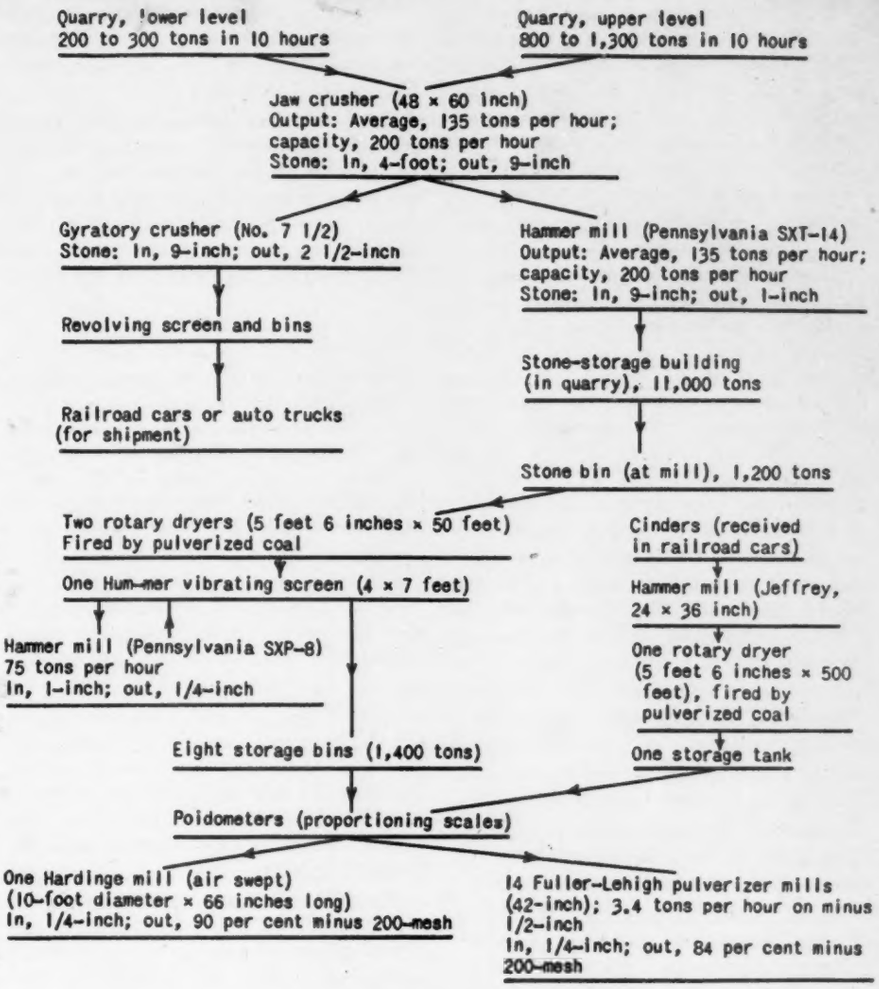

Quarry, lower level
200 to 300 tons in 10 hours
Quarry, upper level
800 to 1,300 tons in 10 hours
Jaw crusher (48 × 60 inch)
Output: Average, 135 tons per hour;
capacity, 200 tons per hour
Stone: In, 4-foot; out, 9-inch
Gyratory crusher (No. 7 1/2)
Stone: In, 9-inch; out, 2 1/2-inch
Revolving screen and bins
Railroad cars or auto trucks
(for shipment)
Hammer mill (Pennsylvania SXT-14)
Output: Average, 135 tons per hour;
capacity, 200 tons per hour
Stone: In, 9-inch; out, 1-inch
Stone-storage building
(in quarry), 11,000 tons
Stone bin (at mill), 1,200 tons
Two rotary dryers (5 feet 6 inches × 50 feet)
Fired by pulverized coal
One Hum-mer vibrating screen (4 × 7 feet)
Hammer mill (Pennsylvania SXP-8)
75 tons per hour
In, 1-inch; out, 1/4-inch
Cinders (received
in railroad cars)
Hammer mill (Jeffrey,
24 × 36 inch)
One rotary dryer
(5 feet 6 inches × 500
feet), fired by
pulverized coal
One storage tank
Eight storage bins (1,400 tons)
Poidometers (proportioning scales)
One Hardinge mill (air swept)
(10-foot diameter × 66 inches long)
In, 1/4-inch; out, 90 per cent minus 200-mesh
14 Fuller-Lehigh pulverizer mills
(42-inch); 3.4 tons per hour on minus
1/2-inch
In, 1/4-inch; out, 84 per cent minus
200-mesh

Fig. 3. Flow sheet of plant

The hammer mill used for secondary crushing in the cement manufacturing system is a Pennsylvania, size SXT-14, equipped with a Pennsylvania size-50 apron feeder and driven direct by a 400-hp. induction motor. The mill receives stone in sizes ranging from 9-in. down and discharges it in sizes from 1-in. down. During wet weather care must be exercised to see that clay does not reach the hammer mill in large lots, else the mill becomes choked. But by distributing the clay through the total tonnage handled the normal amount of clay can be handled by the hammer mill even in the worst weather. One man tends the hammer mill, the stone storage, the belt conveyor, does oiling, etc. This hammer mill and the primary jaw crusher operate about 10 hours a day.

The stone from the hammer mill discharges into a 30-in. bucket elevator 51 ft. between centers, which carries it to the belt conveyor distributing to the stone storage. This horizontal belt conveyor runs the full length of the enclosed stone storage and is of 6-ply rubber-covered belt, 36 in. wide by 228 ft. between centers. The stone is discharged from the belt at any desired point by a Robins No. 3 tripper. This tripper may be fixed in one position or may be set to move slowly back and forth over the full length of the storage, distributing the stone as it moves.

The stone storage is a roofed concrete building, 230 ft. long, 50 ft. wide and 12 ft. high at side walls, with a corrugated iron roof on a steel frame. The capacity is 11,000 tons of stone. Two parallel tunnels beneath the floor each contain a belt conveyor 24 in. wide by 226 ft. between centers. Each tunnel has 23 cast-iron reciprocating cradle feeders to deliver stone from storage to the belt conveyor and this makes it possible to blend the stone thoroughly. In this storage and all through the crushing and grinding system (except at the gyratory crusher for commercial crushed stone) the stone contains 1 or 2% of clay.

The tunnel belt conveyors deliver to a 30-in. bucket elevator which discharges into a steel loading bin of 60-ton capacity. The tunnel belts, reciprocrating feeders, elevator, etc., are driven by a 75-hp. induction motor.

Stone is drawn from the steel loading bin into 50-ton steel railroad-type hopper cars placed beneath it, which are hauled singly to the reinforced concrete hopper beneath the track at the cement mill, a distance of ¼ mile. This transferring of stone from storage to mill is usually done at night only, because there is less interference with quarry operation and the locomotive is thus available for emergency day use.

Stone is fed from this concrete hopper by an 18-in. cast-iron reciprocating cradle feeder to a bucket elevator, with 36-in. 10-ply belt, inclined 64 deg., with a lift of 77 ft. and speed of 255 f.p.m. This elevator delivers into a concrete stone bin, 17 ft. wide by 49 ft. long by 30 ft. high, with a capacity of 1200 tons. Five 12-in. cast-iron reciprocating cradle feeders beneath this bin discharge the stone on to a belt conveyor, 22 in. wide by 66 ft. between centers, over the discharge end of which is suspended a magnet for removing tramp iron. This belt delivers to a 12-in. chain-bucket elevator which in turn delivers through chutes to the two stone dryers.

Drying

Two 5½ ft. by 50 ft. Vulcan rotary dryers are used for drying the stone. They are fired by Fuller-Kinyon pulverized-coal burners, each served by a Buffalo fan with a 2-hp. motor. The moisture in the material entering the dryers varies from 2 to 4% with weather conditions; that in the dried material is about 1/7th of 1%. The dryers are run intermittently through 24 hours a day, for although all the stone must be dried it is not necessary to operate full time to do the work. Cinders, purchased from the railroad companies and crushed in a 24-in. by 36-in. Jeffrey hammer mill, are dried in a similar dryer housed in the same building. The cinders pass to a storage tank, whence they are drawn out and delivered by an elevator to the proportioning scales which are described later. A chain-bucket elevator, with concrete casing and 62 ft. between centers, receives the stone from the rotary dryers and delivers it to a 4- by 7-ft. Hum-mer electric vibrating screen, with ¼-in. screen openings. This screen passes about one-fourth of the total tonnage handled, and sends three-fourths to the hammer mill, whence it passes to the same elevator and screen.

Secondary Crushing

A Pennsylvania SXP-8 hammer mill with 42-in. hammer circle and ½-in. grate bar openings, driven by a 200-hp. electric motor located on the floor level of the dryer building, between the two stone dryers, receives stone in sizes from 1-in. down and reduces it to minus ½-in. It runs intermittently.

The stone passing the Hum-mer screen falls into the chain drag below; this is a Link-Belt chain, 16 in. wide and 66 ft. between centers, driven through a James speed reducer by a 20-hp. motor. This chain distributes the stone to a group of eight concrete bins below it, with a total storage capacity of 1400 tons.

Below the bins the stone is drawn out through slide gates to two belt conveyors 18 in. wide by 57 ft. between centers, which discharge into a 12-in. by 15-ft. screw conveyor. This discharges to a 12-in. chain-bucket elevator which delivers to a small feed bin serving the proportioning scales.

Blending

The stone and cinders are proportioned by Schaffer poidometers, the stone side having a 36-in. belt and the cinders side a 14-in. belt. The proportioning for the cement raw mix is obtained by moving the weights on the two lever arms, which in turn control the opening of the gates over the belts and thus control the quantity of material delivered by the scales. The stone and cinders pass to an inclined belt conveyor, 22 in. wide by 51 ft. between centers, which delivers to the 12-in. by 62-ft. screw conveyor that distributes the material to the concrete feed bin over the Fuller mills.

A temporary elevator takes material for the Hardinge mill from the automatic scales at the point of discharge (but before the inclined belt conveyor) and delivers it to the steel feed bin at the Hardinge mill. This elevator will be replaced later by a permanent arrangement.

Dust from the cement kiln gases is settled by means of a Cottrell electrical precipitator, and is returned to the system, meeting the stone on the belt below the concrete stone bins and just ahead of the automatic scales. The dust collection and transportation system will not be described here, for it has just been placed in operation and does not have an important bearing on grinding practice.

Grinding

Up until the past winter the grinding of stone (plus clay and cinders) was all done in eighteen 42-in. Fuller-Lehigh pulverizers. But during the winter a Hardinge air-swept mill was installed, four Fuller mills being removed to make room for it, and it is expected that the 14 Fuller mills still in use will be removed and replaced with two additional Hardinge air-swept mills. The experience with the Hardinge mill is as yet somewhat limited, but it is expected to effect savings in power, labor and repairs.

The present grinding equipment consists, then, of the following machines:

One Hardinge steel-plate ball mill, 10-ft. diam. and 66 in. long, with Hardinge constant weight feeder, 6-ft. 6-in. rotary classifier, stationary classifier, Clarage fan and collector. The mill is driven at 17.7 r.p.m. by a direct-connected 400-hp. supersynchronous motor. The fan is driven at 875 r.p.m. by a 150-hp. inductor motor.

Fourteen 42-in. Fuller-Lehigh pulverizers, all belt-driven at 160 r.p.m., 6 individually by 75-hp. vertical motors, 2 by one 150-hp. motor, 6 by two 300-hp. motors.

In the air-swept Hardinge mill the air current carries material from the mill to the classifiers and collectors, thus relieving the mill of the work of grinding material that is already sufficiently fine.

All the mills receive material ¼-in. and less in size. The Hardinge mill delivers a product with 91% passing 200-mesh and the Fuller mills (with their present 40-mesh screens) a product with 84% passing 200-mesh.

An accurate indication of power consumption in the Hardinge mill has not yet been obtained. The department power consumption for 1930, when all grinding was done by the Fuller mills, and when feed was ½-in. and smaller, and including power for the dryers, cinders mill, hammer mill at dryers, etc., averaged 21.6 kilowatt hours per ton ground.

Fineness of the ground product is checked hourly by the laboratory staff. Fineness of the product from the Hardinge mill is governed by various settings in the air-classification system; fineness of the product from the Fuller mills is governed by the rate of feed of material to the mills and by the mesh of the screens used in the mills.

The rates of output of the crusher, hammer mills, etc., are shown in the following table, the figures representing the average rate of output in 1930 and not necessarily the capacity of the machines:

RATE OF OUTPUT OF MACHINES

Machine	Tons output per machine hour
Jaw crusher (48x60 in.)	*135
Pennsylvania hammer mill (SXT-14)	*128
Pennsylvania hammer mill (SXP-8)	75
Fuller-Lehigh pulverizer mills (42-in.)	†3.4

*Average rate of output, including time running idle; capacity is about 200 tons an hour.

†When receiving minus ½-in. stone; present practice is minus ¼-in. stone.

The Hardinge mill has not yet been in operation long enough to obtain an accurate measure of output but is guaranteed to grind 22 tons per mill hour.

In 1930 the Pennsylvania SXT-14 hammer mill used two sets of manganese-steel hammers (45 to the set); the Pennsylvania SXP-8 hammer mill at the stone dryers used five sets of manganese steel hammers (36 to the set).

The following figures for 1930 will indicate the consumption of the principal replacement parts in the eighteen 42-in. Fuller-Lehigh mills; material ground, 328,700 tons (stone plus clay plus cinders):

Machine parts	Total used	Number used per 10,000 tons ground
Balls (12¼ in. diam.)	96	2.92
Pushers	76	2.31
Perforated protecting screens	40	1.21

The ground material leaving the Hardinge mill and Fuller-Lehigh mills is cement

raw mix, and after further blending in storage silos it is burned in the rotary kilns.

Safety and First-Aid Work

The plant personnel has been active in safety work and the efforts of last year were rewarded by passing through the full calendar year without a single lost-time accident. The record of the quarry has been more outstanding than that of the cement plant; at the time of writing this it has been 600 days since the last lost-time accident in the plant, but 960 days since the last one in the quarry.

The plant safety committee is made up of foremen and department heads, with the assistant superintendent acting as chairman. Meetings are held once a month, on Friday afternoons. Mass meetings of all the men of the plant are held occasionally and at such times outside speakers are obtained to talk to the men.

In addition to the plant safety committee there is a group known as the Distinguished Service Club. This club is composed of workers of all ranks who have shown unusual interest in safety, who have clean accident records, or who have otherwise distinguished themselves in the safety cause. Any member of the plant safety committee may nominate a worker for membership in the club, and the committee votes on the nomination. One member is elected each month and the oldest member is dropped, this being done to maintain the active membership at 12 men. The member elected each month is given a button to wear, which he retains permanently.

Bulletin boards are maintained in each plant department and the safety bulletins are changed frequently. A housekeeping inspection of the whole plant is made monthly by two workmen appointed anew for each inspection and the departmental ratings are posted on bulletin boards.

Mechanical safeguards are used throughout the plant, but care on the part of the workman is absolutely essential to the prevention of accidents, and the past success of the quarry and plant has been due to enlisting the interest of the workmen in the safety movement.

The personnel of the handling, drying and grinding department at the mill is as follows (supervision is by the cement-mill general foreman):

First-aid training, using the Bureau of Mines methods, is conducted in the plant, having been carried on at intervals since 1924. Most of the quarry and plant men have had first-aid training, and one team is kept in active training.

Quarry Organization and Scale of Wages

The character of the quarry organization is indicated by the following table of workmen employed:

1 quarry foreman.
2 well drillers.
3 tripod and jackhammer drillers.
2 blasters (1 acts as a quarry subforeman).
3 shovel engineers.
3 shovel cranemen.
2 shovel firemen.
2 locomotive engineers (1 in quarry, 1 transfer storage to mill).
1 track-maintenance man.
1 coalman (hauls coal from mill to quarry and distributes to shovels, etc.).
1 night watchman.
1 head repairman (in shop at quarry).
1 blacksmith.
1 blacksmith helper.
1 cable hooker (at foot of jaw-crusher incline).
1 hoistman.
1 crusher feeder.
2 crusher attendants.
1 storage man.

The total quarry force, including crushing department but not including cinders department, drying, final hammer mill (after dryers) and grinding, is 30 men. The quarry foreman is paid a monthly salary, the well drillers are paid a rate varying from 30c. per ft. on the top level to 27c. per ft. on the lower level for the steam drills and from 28c. per ft. on the top level to 25c. per ft. on the lower level for the electric drill; the other workmen are paid by the hour, their rates varying from a high of 68c. to a low of 37c., with an average of 51c. per hour.

Quarrying, Crushing and Grinding Costs

Costs of quarrying and crushing stone (plus 1 to 2% clay), and grinding stone (plus 1 to 2% clay, plus 6% cinders) are given in the following tables. All the figures shown are based on operation for the full year 1930. Quarry costs per ton of dry stone quarried (including 1 to 2% clay overburden) for 1930 when 327,100 tons was produced are as shown in the column following.

No. of men	Job	Hours per shift	Number of shifts per 24 hours	Man-hours per 24 hours
1	Unloading cinders cars, running cinders hammer mill, etc.	8	1	8
2	Operate transfer elevator (at point of dumping cars), 3 dryers, 1 hammer mill, clean up, etc.	8	3	48
1	Repairing at dryers, etc.	8	1	8
1	Storage-bin attendant, proportioning scales, Hardinge and Fuller mills, feed bins, etc.	8	3	24
1	Operates 1 Hardinge mill and 14 Fuller mills	8	3	24
2	Repairing grinding mills, etc.	8	1	16
1	Sweeping in grinding department	8	1	8
	Total	....	....	136

	Per ton
All labor	$0.1348
Supplies other than power, fuel, explosives	0.0302
Electric power	0.0014
Coal (shovels and locomotives)	0.0137
Explosives	0.0550
Stripping	0.0072
Total cost	$0.2423

The cost of crushing 327,100 tons of dry stone (including 1 to 2% clay overburden) in a jaw crusher and one hammer mill, reducing stone from shovel size to 1-in. and less in 1930, was as follows:

	Per ton
All labor	$0.0303
Supplies other than power and fuel	0.0120
Electric power	0.0020
Coal for locomotive (hauling stone from storage to mill)	0.0029
Total cost	$0.0472

The following table shows the cost of drying stone (including 1 to 2% clay overburden), of crushing it in the final hammer mill, of drying cinders and of grinding the stone plus clay plus cinders in eighteen 42-in. Fuller-Lehigh pulverizer mills; and reducing the material from minus 1-in. to 84% minus 200-mesh (1930, tons stone plus clay, 309,800; tons cinders, 18,900; tons mixture, 328,700).

	Per ton
All labor	$0.0733
Supplies other than power and fuel	0.0690
Electric power	0.0225
Coal to dryers	0.0412
Total cost	$0.2060

The cost of handling and delivering purchased cinders to dryer is not included in the table. The plant makes its own electric power; waste-heat boilers utilize the heat of the exhaust kiln gases.

Basic Slag for Pasture Improvement

THE RESULTS of experiments on the improvement of pastures are given in detail by Thomas Hacking of a six-year experiment carried out in England to determine the relative values of basic slag and ground, raw North African phosphate rock as fertilizers for pastures. Measured in terms of the total increase in the live weight of steers and sheep grazed on the different plots, basic slag was approximately 2.25 times as effective as an equivalent amount of P_2O_5 in the form of ground phosphate rock.—*Chemical Abstracts.*

January Asbestos Production in Canada

THE CANADIAN production of asbestos in January declined to 10,190 tons as compared with 10,523 tons in December and 12,901 tons in January, 1931, according to a statement issued by the Dominion Bureau of Statistics at Ottawa. There has been slight change in demand for asbestos during the past two months and quotations have shown little variation.

Minneapolis-St. Paul Sand-Lime Brick Industry Progressive

By Albert Whipple Morse

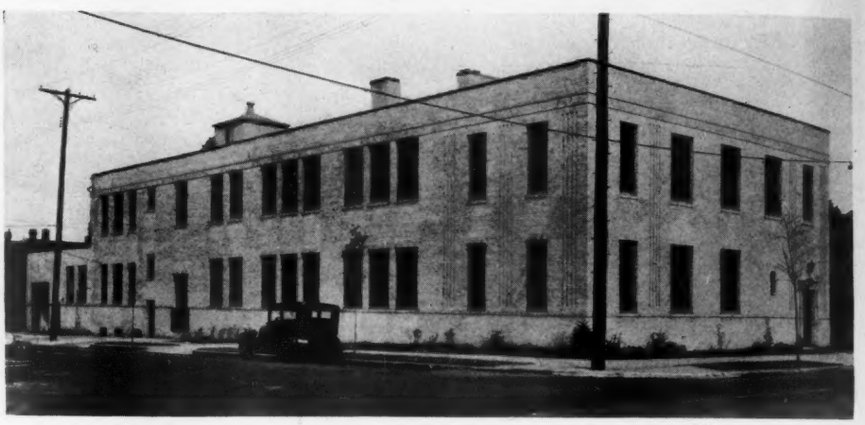
FIFTEEN million sand-lime brick are used in the state of Minnesota in a normal business year, and they are all made within the state. It might be said that the trade territory of Minneapolis and St. Paul is the Northwest, when the sale of sand-ime brick is considered, and one could easily take in a larger area because the product has been shipped several hundred miles from plants in the state.

There are three sand-lime brick companies in Minneapolis and St. Paul. The Belt Line Brick Co. and the Hardstone Division of the C. H. Klein Brick Co. are well-established firms, while the Superior Brick Co. is a new entry in the field, having started production in May of last year.

It is not uncommon for the Belt Line Brick Co. to ship into neighboring states, and Hardstone has sold its brick for jobs in Enid, Okla., and Springfield, Ill. There are sand-lime brick plants in South Dakota, and when that state is considered as a part of the Twin City territory they of course are trade factors.

The fact that Hardstone can ship to Enid in competition with common brick customarily serving Oklahoma jobs is a tribute to the quality and the economy of manufacture of sand-lime brick and it must be recognized that sand-lime brick always has to be prepared to meet the price competition of common clay brick regardless of the superiority of the sand-lime product.

Present business conditions certainly are reflected in building operations, and in the Twin City territory during the first eight months of 1931 the construction of residences was 40% of normal, while apartment building construction was 25% of what is considered normal. In Minneapolis only two office buildings of major importance were under construction in August.



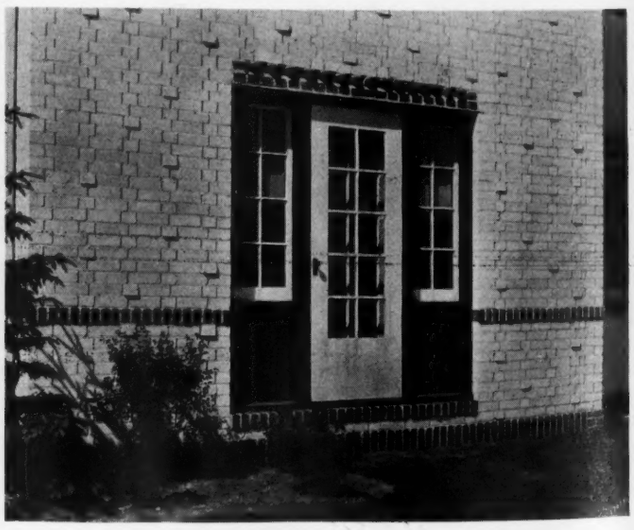
Bakery building in which sand-lime bricks on side walls blend with face bricks on front wall

In the new Northwestern Bell Telephone Co. building, as well as in the Baker property on Marquette Ave., both in Minneapolis, sand-lime brick is being used for back-up behind stone faces, and the side walls of the Marquette Ave. building has this type of brick. The idea of using the sand-lime product for these two purposes is well established among architects and contractors as a result of salesmanship by brick manufacturers.

How well the sand-lime brick on side walls blends with face brick on the building front is shown in the Egekvist Bakeries structure of Minneapolis, where 25,000 sand-lime bricks were used in rear and side walls. The architectural advantage of this product over common clay brick was an important consideration here.

Interior uses open another avenue of sales. At Staples, Minn., 25,000 sand-lime bricks were used for inside walls of a community building. Colored tile inserts added interest to the design. Elevator hatchways and light courts are other places where the sand-

House of sand-lime brick with face brick to offset contrast of dark woodwork



Close-up of house, showing bricks set out to give shadow effect

Residence in $75,000 class built entirely of sand-lime brick

lime product is particularly suitable, its light-colored surface being desirable in courts.

Because sand-lime brick does not absorb moisture readily, the Northern States Power Co. has a standard order with Hardstone, in order that its underground passageways for electric wires and cables may be lined with this material. On the last day of each month the power firm specifies its needs for the next 30 days, and one underground job sometimes takes as many as 7000 bricks.

Chimneys built of sand-lime brick do not absorb moisture and pass it on into the building to such an extent that plastering falls off, according to J. R. Pavek, manager of the Hardstone Division, who is a nephew of C. H. Klein.

Residence Construction Offers Great Possibilities

Residence construction offers one of the greatest possibilities for sand-lime brick in the future. An example of beauty is seen in the accompanying illustration of a cottage or farm house design, where sand-lime is used in combination with face brick for the exterior walls.

This residence is a Belt Line job, and shows what may be expected in designing an $18,000 house. Headers jut from the wall at random, producing an interesting shadow pattern where the surface would otherwise be plain. Face brick relieves the contrast between the white brick and the dark woodwork. A separate photograph shows the detail of the side door.

Another Minneapolis residence with exterior walls of sand-lime brick furnished by the Belt Line Co. was in the $75,000 class. It was an entire sand-lime brick job and took 100,000 bricks, including the house and a retaining wall around the yard. Economy is secured, along with beauty, when skillful design is accomplished.

Minneapolis and St. Paul sand-lime brick manufacturerers have their own ways of advertising. They do not believe in using newspapers or periodicals, and do so only when a new job which they furnished with brick is advertised by the group of contractors and material supply firms interested in the building. A direct-mail campaign was conducted by the Belt Line Co. in 1930 by an agency employed by the company, and circulars were mailed to architects and contractors.

Advertising Methods Used

One circular dealt with "beauty," another had "strength" for its theme, and a third featured the protection of stone exteriors from "stain." Each had illustrative material inside and gave facts sustaining the subject around which the circular was written. There were a large number of these folders, and they were sent with a letter, one every three weeks for a period of six months.

During 1931 an effort had been made by this company to follow up the campaign of 1930, but not through an outside agency. The 1931 direct-mail advertising had been done from the Belt Line office in Minneapolis. In 1930, the effort was on architects and contractors, while in 1931 the time spent on architects had been increased, and some lumber dealers had been approached.

The architect is believed to be the key man, with the most to say about the kind of brick used, but every construction job is followed down the line from owner to architect and then to contractor. Where the specifications of the architect do not permit using sand-lime brick, an effort is made to get him to change them.

The adoption of this product was only a question of general usage, and of course clay brick has been in use for thousands of years. Now that sand-lime brick has been proven desirable as a material for walls of residences, homes costing around $6000 offer an extensive field for this product, and homes so constructed will be an asset to their communities.

While shipments of sand-lime brick formerly were entirely in carload lots, the economy of delivering by trucks is making that method more popular as times passes. It is handier, and a load may be secured on two hours' notice, where the haul is short. Outside of a 60-mile radius the rail shipments are still made.

Advertising circulars used in promoting sales of sand-lime brick

Apartment house with buff colored sand-lime brick, erected in 1913

When the Hardstone Co. was started in South St. Paul about five years ago it had an initial merchandising problem of large proportions, and solved this by mailing samples of its sand-lime brick, with price quotations and an explanation of how the bricks are made. It took about six months to get a reaction, but when the orders started to arrive they came from many persons they had never seen.

During the first year's operation the company sent 400 samples, 1500 were sent the second year, and 800 the third year. After that samples were sent only on request. One brick brought an order for a carload from Oklahoma. Sending samples was responsible for 30% of the sales the first year. Parcel post was used to send them, and the postage on each amounted to about 30 cents.

Because of the fact that it got the business for the South St. Paul school house, the Hardstone Co. ran an advertisement in the local newspaper once a week for 15 weeks, but otherwise it has not done any steady advertising, in either newspapers or magazines.

Brass calendar stands for desks, costing $2.60 apiece in lots of 100, were given to customers one Christmas by the Hardstone Co. At another time billfolds costing $2.50 each were given away, and again a nail file and comb set which cost the firm $2 apiece was presented to customers. The idea back of this was to give quality merchandise and to limit the number of articles given away.

Advertises to Help Dealers

IN RECENT MONTHS a noticeable degree of studied unselfishness has come to characterize the U. S. Gypsum Co.'s dealer policies. It is influencing the company's advertising conspicuously today. Customers and prospects are finding it mirrored more and more often in what salesmen say and do in their contacts with them.

This unselfish attitude—and it may fairly be called that—frequently leads the company to put the dealer's welfare above its own, states a recent article in *Printer's Ink*.

This year the company is putting its energies back of an idea. The idea, briefly, is this: Building material dealers need (1) a definite plan that will create an opportunity for them to sell and serve every prospect in their communities, and (2) a definite selling technique that will make it just as easy as possible for the prospect to buy once he has been located.

To introduce this plan a credit memorandum was mailed to every one of the company's dealers. This was a teaser telling the dealer only that a few days later he would receive an analysis of his 1932 problem.

Five days after the dealer received the credit memorandum the 1932 analysis was delivered to him. Running through this hastily, the dealer who expected to find it an advertisement for U. S. Gypsum materials discovered that it had an entirely different theme and was so pertinent to his interest as a business man that he had to give it a careful study.

The analysis talked about three classes of prospects: 1, Those who came into the retailer's office regularly; 2, those who pass his place of business occasionally and 3 those people who live in the dealer's community but neither come into his place of business nor pass it.

The analysis describes in detail just how each of these classes can and should be approached and sold. It talks about the kinds of merchandise the building-material dealer stocks that are most saleable and the places where the dealer could expect to make sales.

It offers suggestions for finding out where repair and remodeling jobs are needed and how the cost of these jobs may be handled on a deferred payment basis. Then the analysis pictures some of the U. S. Gypsum displays, mailing pieces and newspaper electros that the company makes available to its dealers.

About the middle of February another mailing piece went out to a limited list. This was a 16-page booklet entitled "The Home Inspection Service."

It describes in complete detail exactly how a dealer can learn systematically where the market is in his community. It tells him how to go about making appointments to inspect homes from roof to cellar, how the inspection should be made, how the results of the inspection should be presented to the home owner and how to sell the materials that the inspection discloses are needed.

With the booklet a broadside was enclosed announcing the opening page of the consumer advertising campaign.

Two weeks later a booklet on "Financing Repair Work and Remodeling" was mailed to the dealer list.

The booklet describes five finance plans that a dealer can use to help the customer pay for his remodeling.

Just a few days ago the first advertisement, designed to sell the home remodeling idea to consumers, appeared in one of the large national weeklies. This carried a coupon by means of which interested readers may obtain detailed information concerning the home inspection service already mentioned. Naturally all dealers have been urged to tie up with the consumer advertising which does not attempt to sell any type or brand of materials. It is being published wholly in the interests of dealers who will render the home inspection service it describes. The leads produced by national advertising will be turned over to dealers who cooperate in the campaign.

"The condition that we are working to bring about," says Mr. Oren, advertising manager, "is one where the man whose home really needs repairing or remodeling now and the dealer who can sell him the materials needed can get together with a minimum of difficulty and delay.

"We know that success in retailing is earned by displaying goods, by salesmanship that gives the prospect convincing reasons for buying and by reaching out into the community and bringing people to the place of business.

"Our job as advertisers is to help the building-materials dealer develop into a better merchant and to tell him what our experience dictates he can profitably do. We are committed to that aim in our promotional work, regardless of the sale of our products.

"For a long time our policy has been that if we can really help the dealer, we shall be pretty certain of getting our share of his business. That plan has succeeded in the past. We are confident that in times like the present it will succeed to a greater degree than ever."

Methods and Costs of Mining and Preparing Gravel and Sand for Market at the Plant of the Seaboard Sand and Gravel Corporation, Port Jefferson, N. Y.*

By Anderson Dana†
Vice-President, Seaboard Sand and Gravel Corp.

SAND and gravel have been obtained from the north shore of Long Island for the past 40 or 50 year, mainly for use in the building development of New York City. Originally, small sailing vessels were employed in the trade. These were loaded by one-horse dump carts backed against the string piece of the sand-bank dock. Where their destination was a dock, the vessels were unloaded by wheelbarrows. In many cases, however, where no dock was available, they were beached, and the cargo was shoveled into carts driven into the water alongside. It was during this early period that the general name "Cow Bay sand" was given to sand coming from Long Island, as Manhasset Bay, also known as Cow Bay, was the source of most of the material. Nowadays, only a small portion of the brown sand coming into the metropolitan district actually comes from Cow Bay. Ninety per cent. of it is from property facing Hempstead Harbor, but it is still called "Cow Bay sand." Hempstead Harbor and Manhasset Bay form the two sides of Manhasset Neck, as can be seen from the sketch map (Fig. 1), so that both properties are parts of the same general deposit.

The beginnings of the industry were all land operations, carried on by horse and cart, and later by steam shovel and narrow-gage railway. Mechanical screening plants with washing facilities for the preparation of the product were gradually introduced, as construction engineers became more exacting in their specifications.

In the early part of the twentieth century the demand for materials led to the opening of deposits further from New York City, and an operation was commenced at Eaton's Neck, about 15 miles to the east. This operation was an innovation for the industry in this part of the country. It consisted of a ladder dredge which rested on skids on the bank of a canal which ran through the beach. The ladder, with its continuous string of digging buckets, was lowered into the canal and brought up the material which was delivered to screens. The finished material in various sizes was wheeled to storage piles by barrow. When enough of any given size of material was accumulated, a scow was brought alongside the bank of the canal and the material wheeled on board over gangplanks. When the ladder had dug as deep as was practicable in any one place, the whole rig was skidded along the bank a few feet and work begun anew. It can readily be seen from this description how primitive this operation was, and about 1911 it was abandoned. A screening plant was erected on the southern point of Eaton's Neck and a bucket dredge installed to do the digging. Sand and gravel were first dug from the canal where the earlier operation had been carried on. The material was loaded on scows and brought to the screening plant, where after treatment it was reloaded on scows for the market.

About 1915, sand and gravel mining moved still further east. A ladder dredge was put to work just outside the entrance to Port Jefferson Harbor. This operation, however, was short lived, as the dredge was wrecked in a storm after working only a few months. Nothing more was done in this district until early in 1919 when a bucket dredge went to work in the harbor itself. This dredge burned in the fall of the same year. Both of these dredges were self-contained units with screening plants for preparing the product on board. In the latter part of 1919, a self-contained suction dredge started work in Port Jefferson Harbor and the same company is still operating there with a newer and larger dredge of the same type, loading finished material directly onto scows alongside.

In 1923 our company began producing material in Port Jefferson, using a suction dredge in conjunction with a crushing and screening plant on shore to which the material was pumped through a pipe line.

Geology

The surficial deposits of Long Island are of glacial origin. They are composed almost entirely of sand and gravel, particularly along the north shore, but there are occasional beds of clay and bowlders. The clay varies in quantity and occurs at almost any depth in the deposits. The bowlders, how-

*Abstract from U. S. Bureau of Mines Information Circular 6592.

†One of the consulting engineers, U. S. Bureau of Mines.

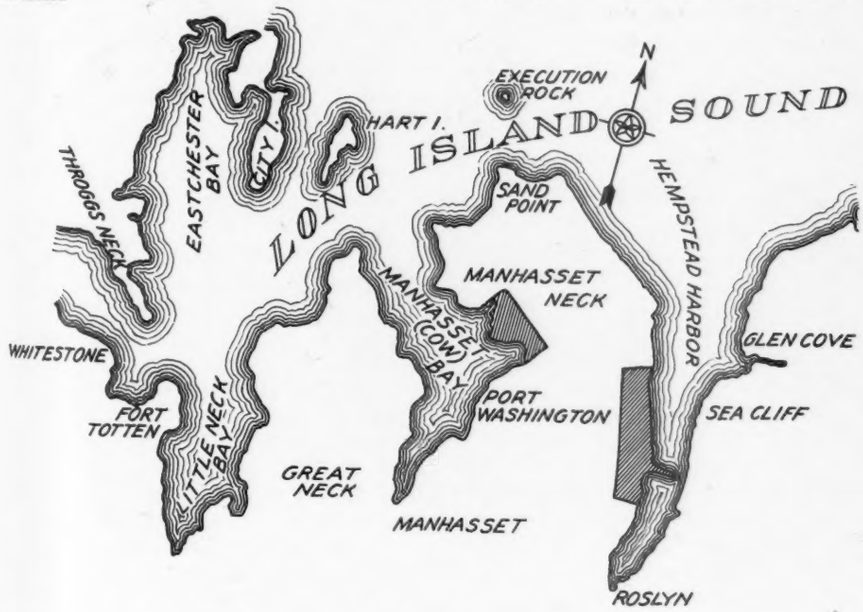


FIGURE 1.-SKETCH MAP SHOWING LOCATION OF PROPERTIES PRODUCING "COW BAY" SAND

ever, are more systematic in their occurrence. In every case in the writer's experience, they are found at the surface, or within 8 or 10 ft. of it. The overburden on Long Island consists of top soil, which never exceeds a depth of 2 ft. and is not more than 4 or 5 in. thick on the property now being worked. Here the sand and gravel occur in well-defined strata, which vary in thickness from a few inches to several feet. These strata are more clearly defined near the surface where the gravel content is much heavier than deeper in the bed. With depth the layers disappear and the material seems to be largely sand with occasional pebbles in it. No clay has been encountered in the bank now being worked.

Development

Before commencing operations, two methods of handling the material were considered. The first method comprised mining with a steam shovel, and delivering the material to the screening and washing plant by truck or cars. The second method was mining with a hydraulic dredge. In this case the dredge could start in the harbor, dredge its way into the property digging to a determined maximum depth and pumping the material to the screening plant. All the arguments were in favor of the dredging operation. It was not only cheaper than mining by steam shovel, but the recovery from a given acreage was much greater, as a shovel could not operate below high-water mark, while a dredge could easily reclaim an additional 40 ft. in depth.

Characteristics of Material

The chemical analysis of Port Jefferson sand is as follows:

	Per Cent.
SiO_2	95.98
Fe_2O_3	2.37
Al_2O_3	0.83
CaO	0.29
MgO	0.03
SO_3	0.01
Cl	0.03
Loss on ignition	0.46

The gravel is practically pure quartz with a small percentage of calcareous conglomerate.

Testing and Calculation of Available Tonnages

The topography of the deposit rendered test borings unnecessary, as the promontory, of which the property forms the larger part, has three sides exposed and clearly shows the strata of sand and gravel from the surface to water level. Test pits were dug in various places in the banks to confirm the fact that the original formation was exposed and not merely covered by slides. These pits were scarcely more than burrows which a man with a shovel could dig in an hour, so that their cost was negligible. A rough survey of the property gave elevations from which it was simple to calculate the amount of material reclaimable. This was done by multiplying the area by the average elevation, plus the depth below high water to which it was thought feasible to dredge. No allowance was made for the slight overburden or for the swell in finished material over material in place. Experiment determined that a cubic yard of screened sand weighed 2,450 lb. and a cubic yard of gravel 2,550 lb. loose measure.

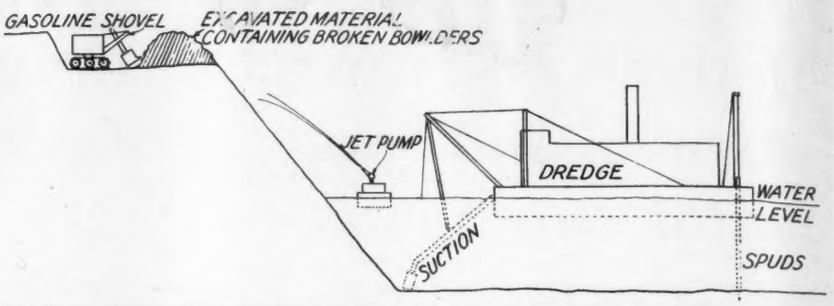


FIGURE 2.- SECTIONAL SKETCH OF DREDGE AND GRAVEL BANK, SHOWING METHOD OF OPERATION

Mining Method

Having determined on a suction dredge as the means of mining the material, the question of the preparation of the sand and gravel remained to be decided. Owing to the many specifications which have to be met in the metropolitan market, calling for at least a dozen different sizes and mixtures, it was evident that all the necessary screening could not be done on the dredge itself. The dredge, also, could not provide storage except for materials that were being immediately loaded on scows. These two factors led the company to build a screening and storage plant on shore to which the dredge would pump the material. A shore plant also provided facilities for crushing oversize gravel and small bowlders into commercially salable material. Fig. 2 is a sketch of the dredge and gravel bank, showing the method of operation.

The 20-in. suction dredge "Whirlwind," which is shown in side view in Fig. 3, and about 40 wooden pontoons were purchased for the work. The dredge has a wooden hull 140 ft. long, 38 ft. wide, and 11 ft. deep. The pontoons are rectangular wooden floats 6 by 12 ft., with 4-ft. sides. They carry the pontoon pipe in a cradle on deck with the pipe running athwartship. When it becomes necessary to acquire more pontoons, the wooden type will be abandoned for those of cylindrical steel construction.

The "Whirlwind's" pumping and power plant consists of a 20-in. Morris Machine Works' centrifugal pump, driven at 190 r.p.m. by a 750-hp. triple-expansion, direct-connected Morris steam engine, powered by two 400-hp. Babcock and Wilcox stationary boilers, carrying 180 lb. of steam. There are 130 four-in. fire tubes 18 ft. long in each boiler. The auxiliary machinery consists of a Mundy 5-drum, 8 by 12 in. hoisting engine to handle the suction and spud hoists, and the two swing lines. A 12 by 12 in. Lambert engine drives the suction cutter by a shaft running down the ladder and geared to the engine at the ladder trunnion. Side and end views of the cutter head are shown in Fig. 4. In addition there was a 7-kw. generator, driven by an American Blower Co. engine, the necessary battery of feed pumps, and a C. H. Wheeler condenser.

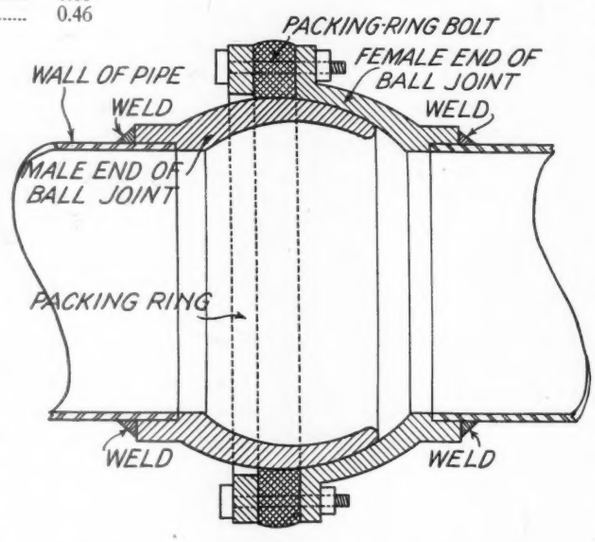


FIGURE 5.- SECTION OF BALL JOINT IN PONTOON PIPE LINE

Plant

Material is transported from the dredge through a pipe line of 40-ft. lengths connected by ball and socket joints (Fig. 5) to a spreading table (1 in Fig. 6) at the north end of the plant at an elevation of about 35 ft.

The spreading table is 28 ft. 9 in. long by 16 ft. 5 in. wide and is built of wood sheathed with ¼-in. steel plates. It slopes at an angle of 10 deg. toward the plant, and its purpose is to slow down the water and spread out the material, as its name implies. A plow at the lower end of the table divides the material into two streams which flow into two 5 by 16 ft. double-jacketed, Link-Belt revolving screens (2 in Fig. 6). The

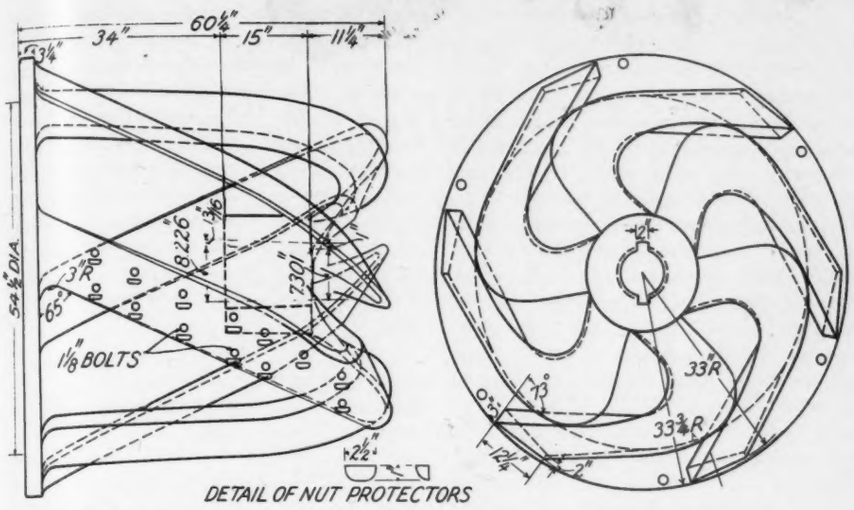


FIGURE 4.-SIDE AND END VIEW OF CUTTER HEAD

inner plates of these screens are manganese steel with 1⅞-in. perforations. The intermediate jackets are woven from ¼-in. manganese-steel wire and have ½-in. square openings. The outer jackets are formed of oblong-mesh wire cloth with openings of ⅛ by ⅝ in. The screens are set on a slope of 1½ in. to the foot and make 13 r.p.m. They are supported on trunnions and are belt-driven from a line shaft operated by a 50-hp. motor. Each screen handles about 300 tons per hour.

Entering the screens, the pebbles which are too large for commercial use pass over the 1⅞-in. openings of the inner screens and out at the lower ends, dropping through chutes to two No. 6-K, Allis-Chalmers crushers which have 1¼-in. discharge openings. A bucket elevator returns the material from the crusher pit to the spreading table, where it again has an opportunity of passing through the screens. This elevator is 40 ft. between centers and has a 22-in., 12-ply belt with ⅜ and $\frac{1}{16}$ in. rubber covers. Its buckets are 22 by 10 by 11 in., it travels 182 ft. per minute, and is belt-driven off the same line shaft that operates the main screen. The commercial-size pebbles drop through the 1⅞-in. holes and the larger of them are carried on the intermediate jackets to chutes which lead to the gravel conveyor belt (1 in Fig. 7). The smaller-sized pebbles and sand, with the water, drop through the intermediate jackets onto the outer jackets which carry their oversize to the same chutes as the larger pebbles. The sand and water pass through the outer jackets into settling tanks (3 in Fig. 6) from which the coarse sand is reclaimed by belt and bucket elevators (4 in Fig. 6) and deposited on the storage piles The sand elevators are 65 ft. between centers and have 36-in., 12-ply belts with ⅛ and $\frac{1}{16}$ in. rubber covers. They carry 8 by 11 by 18 in. buckets, staggered on 12-in. centers, and travel 288 ft. per minute. Each elevator is driven by a 60-hp. motor through a Morse silent-chain drive. The waste water overflowing from these settling tanks is carried away by unlined wooden flumes to an unused part of the property, from which it finally finds its way back into the harbor.

Originally it was hoped that the proper quality of sand could be reclaimed from these settling tanks. It was soon found, however, due to the small size of the tanks (they are only 13 ft. 9 in. long, 10 ft. wide and 8 ft. deep), that there was too much agitation of the water for the fine sand to settle, and it became necessary to construct two secondary settling tanks of much larger capacity from which the fine sand is now reclaimed by a stiff-legged derrick handling a clamshell bucket, and mixed with the coarser sand from the original tanks. The secondary settling tanks are elliptical and are 60 ft. long, 42 ft. wide, and 9 ft. deep.

To return now to the gravel conveyor belt. All sizes of merchantable gravel are deposited on the lower end of this belt. Rising at an angle of 18 deg., it conveys the material to an elevation of 40 ft., and delivers it to a 5 by 20 ft., double-jacketed, Link-Belt revolving screen (3 in Fig. 7). The inner screen has 1¼-in. holes, the inner jacket has ⅞-in. holes, and the outer jacket has ⅜-in. holes. The screen is chain-driven at 14 r.p.m. by a 40-hp. motor which also operates the gravel-distributing belts. It has an inclination of 1½ in. to the foot and handles about 200 tons per hour. This screen separates the material into three commercial

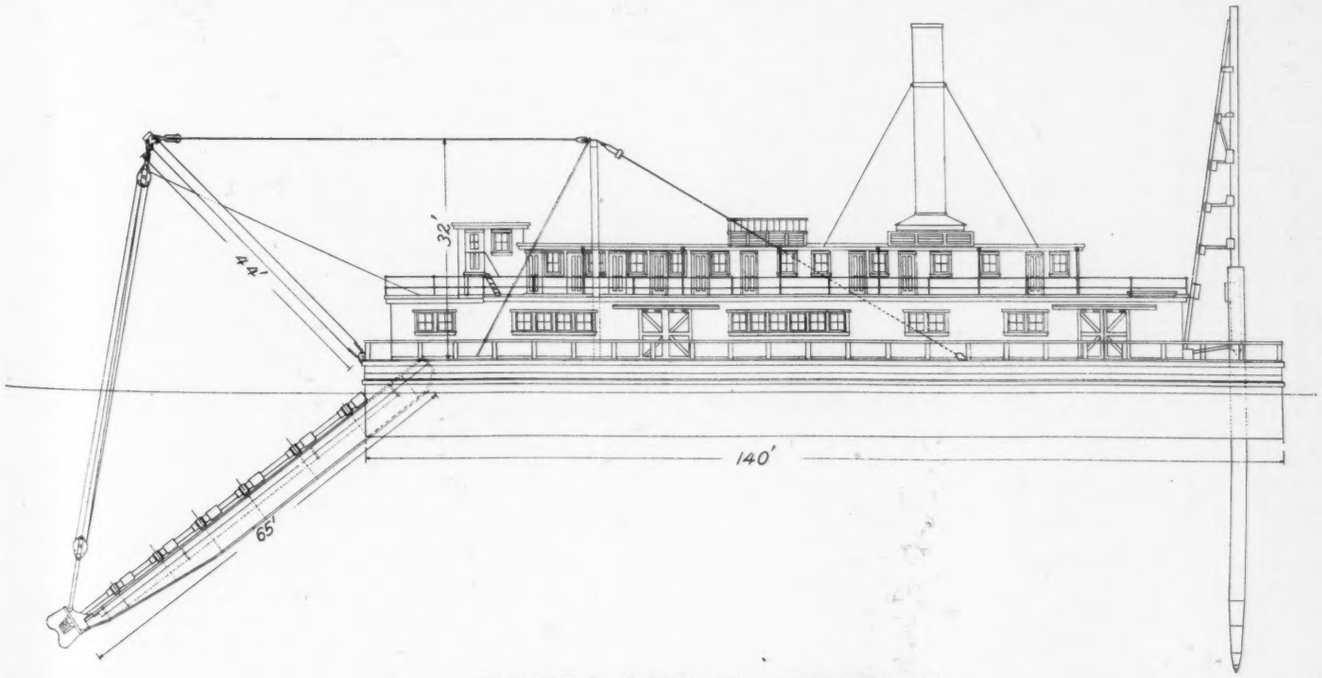


FIGURE 3.-SIDE VIEW OF DREDGE

sizes of gravel: namely, 1½-in., ¾-in., and ⅜-in.

The 1½-in. gravel passes over all the openings in the screen to another conveyor belt (4 in Fig. 7), which delivers it to its storage pile. This conveyor is 50 ft. between centers and has a 30-in., 6-ply belt, with ⅛ to $\frac{1}{16}$ in. rubber covers. It travels 425 ft. per minute.

The smaller sizes of gravel from the finishing screen pass into hoppers, and are carried to their different storage piles by two other belts (1 and 2 in Fig. 8). Both of these belts are 32 ft. between centers and travel 425 ft. per minute. They are 30 in. wide and 6-ply with ⅛ and $\frac{1}{16}$ in. covers.

As may be seen from Fig. 6, the plant is roughly star-shaped, the two sand piles and the three gravel piles forming the five points of a star.

Under each storage pile there is a tunnel containing gates in the roof and conveyor belts which carry the material to the main loading tunnel (7 in Fig. 7), and onto the main loading belt (6 in Fig. 7), which runs out onto the dock. The belts feeding the main conveyor belt are all 36 in. wide, 6-ply, with ⅛ and $\frac{1}{16}$ in. covers. The east and west side sand belts are 75 and 130 ft. between centers, respectively, and travel 455 ft. per minute. Between centers the ¾ and ⅜ in. gravel belts are 55 and 105 ft., respectively. The main loading conveyor is a 42-in., 8-ply belt with ⅛ and $\frac{1}{16}$ in. rubber covers and travels 450 ft. per minute between 245-ft. centers. These conveyor belts last about two years.

In the last year it has been found necessary to make a fourth size of gravel, and a storage pile for ½-in. material has been added at the southwestern end of the plant. This size has been made by adding a third jacket to a section of the finishing screen. This addition is not shown in the figures.

Loading Finished Material

One feature of the plant which may be of interest is the method of loading scows. The loading conveyor projects about 18 ft. beyond the line of fender piles against which the scows lie, and delivers the material into a movable steel chute which travels back and forth at right angles to the dock. This travel is sufficient to cover the entire width of a scow. The chute is operated by a 5-hp. motor driving through a worm gear which holds the chute at any given angle when the motor is turned off. On the dock is a double-drum winch, which moves the scows along the side of the dock, enabling the chute to deliver to the entire length of their cargo compartments. One man, therefore, by manipulating the winch and the loading chute, can so load the scows that there is practically no trimming to be done after the full cargo is aboard. The loading dock and chute are shown in Fig. 7.

The trimming of a loaded boat is important, as sand and gravel in this district are sold by the cubic yard, and the only means of arriving at the contents of the scow is by measurement of the cargo, which must be trimmed to a regular shape.

With the exception of the dredge itself, the entire operation is completely electrified. Power is purchased from the Long Island Light and Power Co. and costs about 2½c. per kilowatt-hour. All motors of more than 25 hp. operate at 2,200 volts, and those of less power at 220 volts.

When the dredge "Whirlwind" started it was equipped with a manganese-steel cutter (see Fig. 4). Trouble was constantly encountered during the first three years because bowlders jammed in the cutter blades, which necessitated raising the ladder and prying the bowlders loose. About three years ago, it was determined to try to operate with a straight suction and to do away with the cutter. A special suction head was constructed with crossed bars to prevent oversize bowlders from getting into the suction pipe and was also equipped with water jets to assist in loosening the material on the bottom. This suction head proved satisfactory and its use resulted in a saving of about 30% in steam consumption on the dredge.

Shortly after the operation started, and the dredge had begun to work its way into the bank, it was found that there were constantly recurring slides caused by the suction undermining the bank. Anywhere from 50 to 200 tons of material might suddenly slide down into the water. This was extremely dangerous, and several spuds were broken by the waves created by the slides. In order to overcome this, a small float was constructed on which was placed a 1⅝-in. monitor nozzle attached to a 4-in., single-stage centrifugal pump driven by a direct-connected 100-hp. motor. This nozzle plays constantly upon the bank ahead of the dredge, washing it down to a safe angle, so that no slides are possible (see Fig. 2). The pump delivers 600 gal. per minute at 115 lb. pressure.

The steady stream of water against the bank has another beneficial effect. It uncovers all bowlders that may be in the bank, and by careful manipulation it is possible to ease them down to the water level where they can be picked up and carried out of the path of the dredge and thus lessen the danger of stoppage at the suction head.

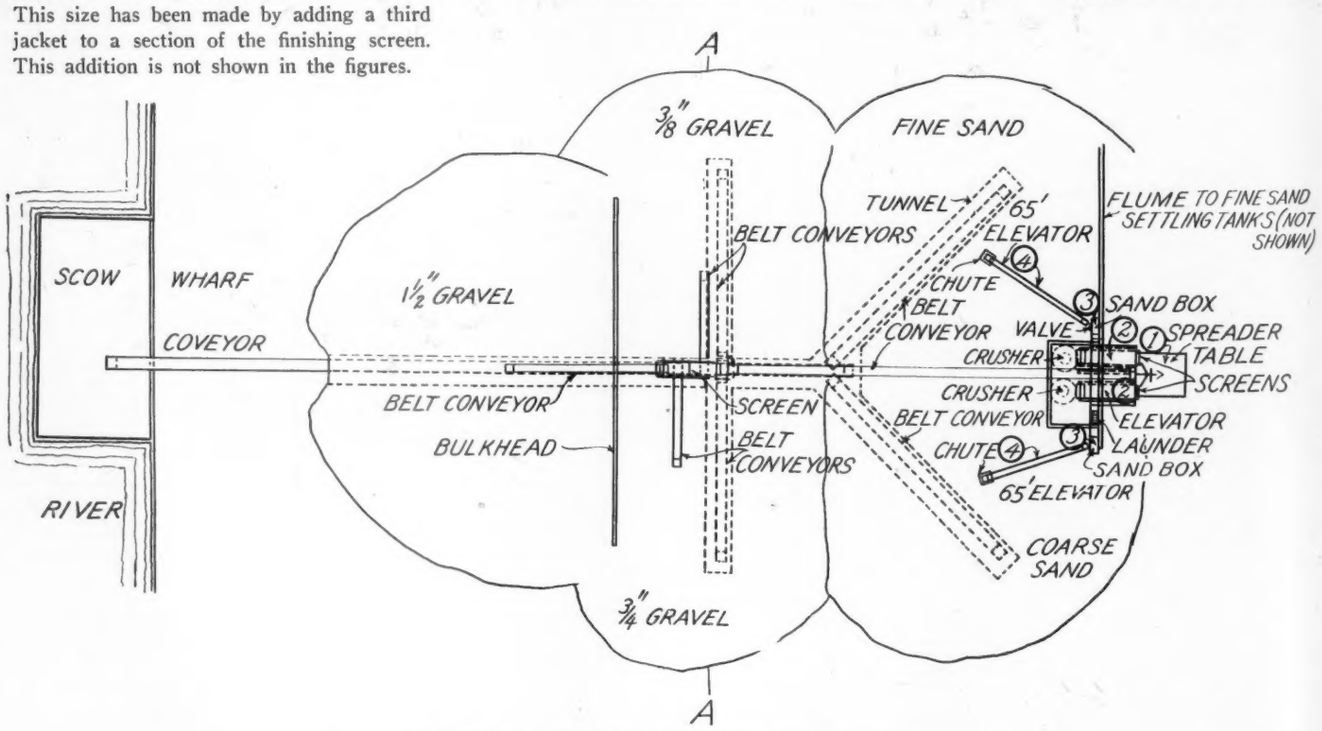


FIGURE 6.-PLAN OF SHORE PLANT

Small bowlders are picked up by hand and the larger stones are removed by a small derrick on a scow which carries them to an area that has been dredged where they are thrown overboard.

Another advance in the battle against bowlders was made by the acquisition of a 1-yd. caterpillar shovel. This operates on the top of the bank, digging to a depth of 10 or 12 ft. (see Fig. 2). The shovel merely turns the material over and in handling it the bowlders are uncovered. As soon as one is found, it is drilled and shot, or else sledged down to a size that will pass in the pumps and pipe line. This shovel operates for about eight months of the year.

After a few months of operation in 1923, it was found that the dredge did not have sufficient power to deliver the desired quantity of material to the spreading table in the plant. A booster pump was therefore installed on shore, driven at 210 r.p.m. by a 350-hp. motor. This arrangement worked successfully for two years, until the distance between the dredge and booster became uneconomical.

The booster and its motor were thereupon installed upon a float and moved up to a position 400 or 500 ft. to the stern of the dredge, where the booster worked most efficiently. In 1930 the dredge had eaten its way so far into the bank that even with the aid of the existing booster it did not have power enough to deliver the required quantity of material. A 650-hp. motor was, therefore, installed in place of the 350-hp. motor, and the speed of the booster, now driven by a Texrope drive, was increased to 220 r.p.m. The distance from the dredge to the booster is kept at about 400 ft., as this distance has been found to be the most economical operating position. The distance from the booster to shore varies from 300 to 1,200 ft. according to the position of the dredge.

The pipe line through which the material is transported from the dredge to the screening plant is 20 in. inside diameter and is made up of 40-ft. lengths connected by ball-and-socket joints. The pressure in the line varies between 30 and 40 lb. per sq. in. This pressure frequently blew off the rubber sleeves which were originally used as joints, and necessitated the adoption of the ball joint which is illustrated in Fig. 5. Each 40-ft. length of pipe is carried by two pontoons.

On shore the pipe line is flanged and bolted and is carried up to the spreading table on a trestle.

During the first few years of the operation, it was found necessary to have this pipe specially made by welding. This method was extremely expensive, as pipe with a ⅜-in. wall cost between $11 and $12 a ft. In the last five years, however, it has been possible to obtain wrought-steel pipe at approximately $6 a foot. Not only is the

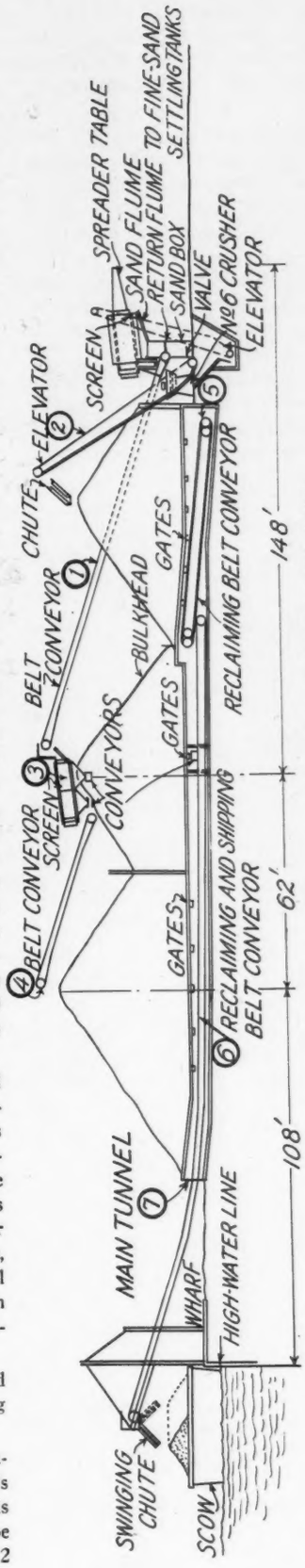


FIGURE 7.-LONGITUDINAL SECTION OF PLANT

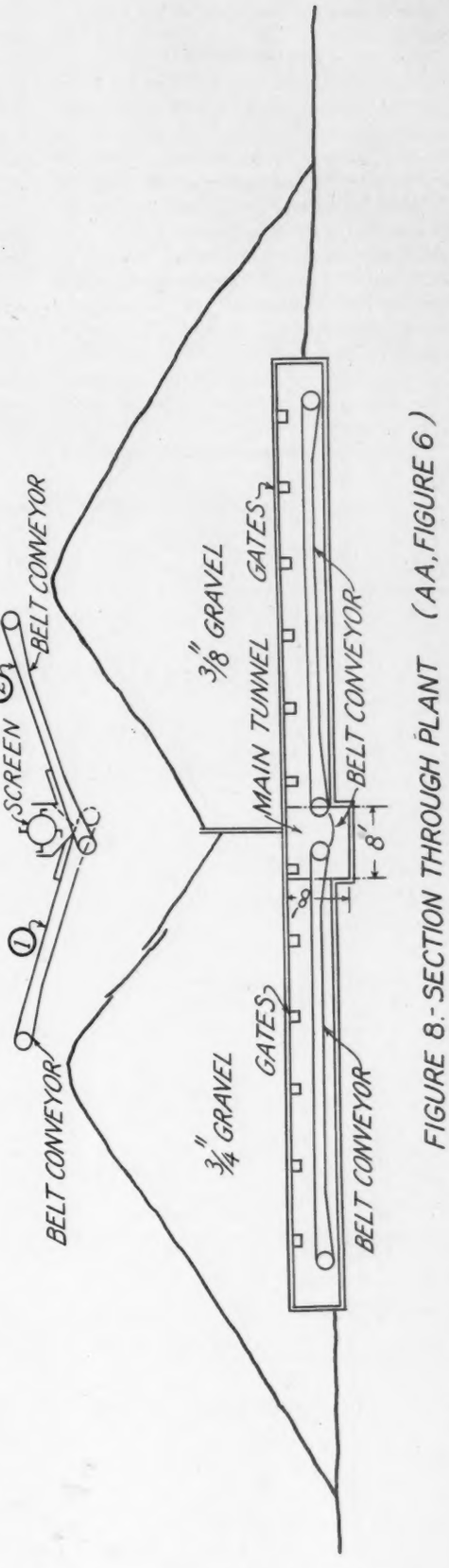


FIGURE 8.-SECTION THROUGH PLANT (A A, FIGURE 6)

cost per foot cheaper, but the wall of the pipe is ½-in. thick, so that it lasts considerably longer.

Fig. 9 shows a flow sheet of the plant.

Transportation

After scows have been loaded at the plant, they are towed out to a stakeboat, maintained in the harbor of Port Jefferson, to await transportation to market. The shifting is done by a company-owned tug, the "Takana," a wooden vessel 69½ ft. long, 18 ft. 7 in. in the beam, and drawing 8 ft. 8 in. The empty scows are moored to one side of the stakeboat, and the loaded scows to the opposite side. The majority of the company-owned scows are 118 ft. long, 37 ft. wide, and 10 ft. deep. Chartered scows vary from this size down to 112 by 32 ft. All scows take deck loads and their capacity varies from 600 to 1,000 tons.

Towing to the various markets which our company serves is done by contract. The principal market is in the New York metropolitan district. Scows for delivery in this district are towed down the Sound in flotillas of five to eight. Arrived at a central point in New York Harbor, the tow is broken up and the scows distributed to various docks.

A considerable part of the company's output is marketed in towns along the northern shore of Long Island Sound. Delivery to these destinations is usually made in single scows, as there is seldom call for more than one scowload at a time.

This company maintains no retail yards or any unloading facilities, the material invariably being sold f.o.b. scow alongside dock at destination.

From the experience of more than eight years, it is safe to state that the deposit which the company is mining contains about 70 per cent. of sand and 30 per cent. of gravel. Of the total gravel mined the percentages of the different commercial sizes produced are as follows: 1½-in., 20%; ¾-in., 50%; ½-in., 15%; ⅜-in., 15%.

The average life of the various screening surfaces is as follows: The fine, oblong-mesh wire on the outer jacket of the main screen handles 180,000 cu. yd., the manganese-steel wire cloth of the inner jacket carries 1,200,000 cu. yd., and the inner screen of manganese-steel plate carries 1,400,000 cu. yd. before they have to be replaced.

On the finishing screen, which handles only 30% of the plant's total output, it has never been thought necessary to use manganese steel because ordinary steel plate handles 375,000 cu. yd. before replacement is necessary. For the same reason, ordinary steel-wire cloth is used on the outer jackets, which handle about 250,000 cu. yd. before they are worn out.

Organization

The organization of personnel is shown in Fig. 10. The company has no safety organization, but the superintendent, assistant superintendent and timekeepers have all received instruction in first aid.

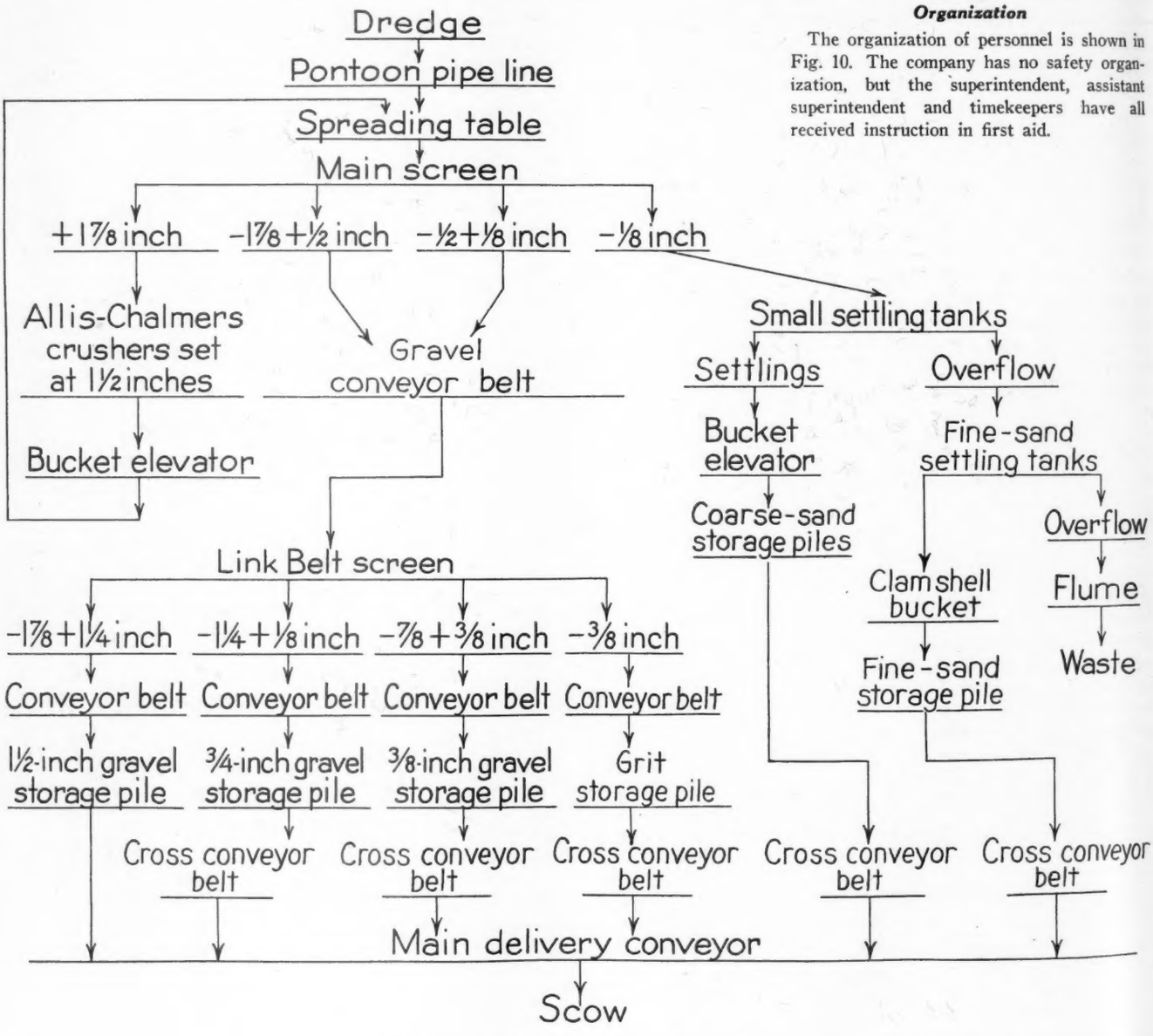


Figure 9.-Flow sheet

SUMMARY OF COSTS
(Period covered—January 1, 1929, to December 31, 1929)
Total sand and gravel produced, 1,654,779 cu. yd. = 2,007,224 short tons

OPERATING COSTS PER DRY SHORT TON OF SAND AND GRAVEL PRODUCED

	Labor	Supv.	Power	Fuel	Supplies	Misc.	Total
Dredging and pumping	$0.0559	$0.0030	$	$0.0142	$0.0445	$0.0338*	$0.1514
Crushing, screening, and washing	0.0510	0.0030	0.0369	.....	0.0466	0.0456*	0.1831
Total operating costs	0.1069	0.0060	0.0369	0.0142	0.0911	0.0794	0.3345

*Includes pro rata of towboat, truck, etc.

Division	Per cent of total operating cost
Labor	31.9
Power and fuel	15.3
Supplies	27.2
Supervision and miscellaneous	25.5

LABOR PER TON OF MATERIAL PRODUCED

	Man hours
Dredge	0.0217
Plant	.0216
General (machine shop, floating equipment, repairs, etc.)	.0624
Total	0.1157

Electricity and Coal Consumed

On the dredge 0.0024 ton of coal is consumed per ton of material produced. In the plant, 1.032 kilowatt-hour is used per ton of material produced.

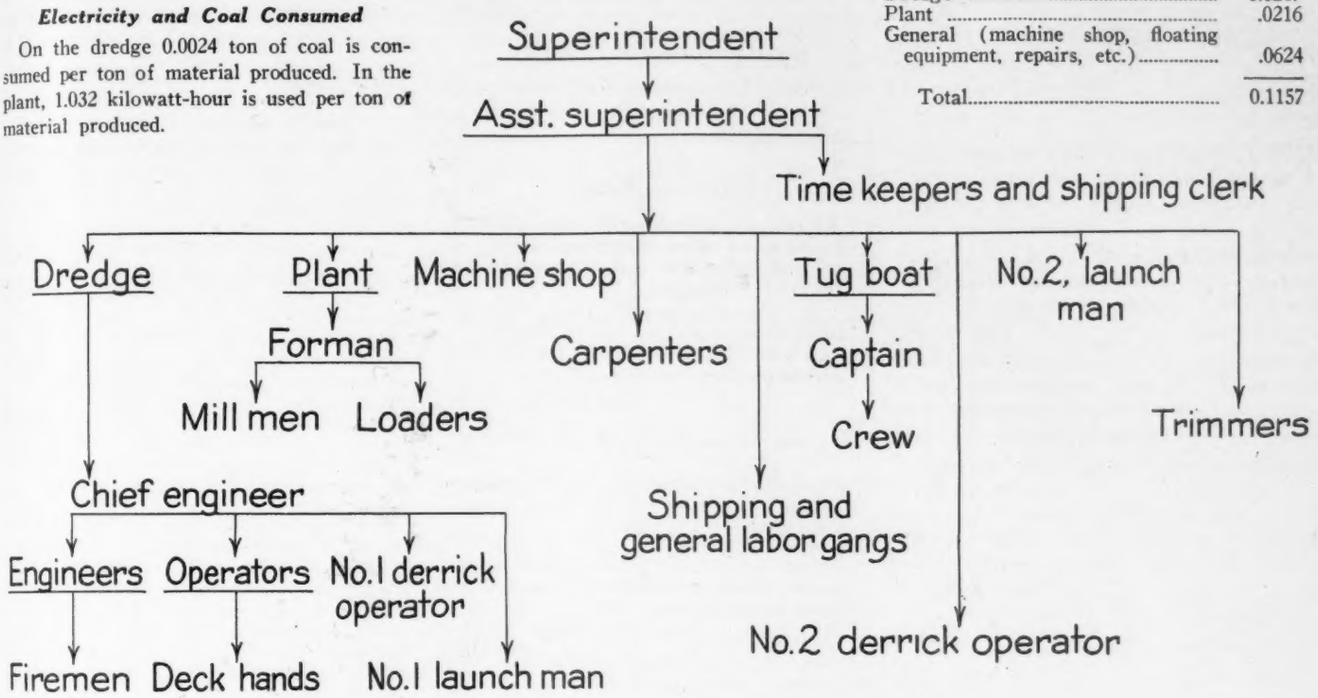


Figure 10.- Organization chart

Gypsum Industry in 1931

WITH the continued recession in building construction throughout the United States, the gypsum industry was able to utilize only about 25% of its existing plant capacity in 1931, says the United States Bureau of Mines. The amount of crude gypsum mined during 1931 was about 2,519,000 short tons or an estimated decrease of 27% from the output during the previous year. The amount of domestic and imported rock sold as crude gypsum in 1931 was 775,242 tons, while the amount of calcined gypsum produced from domestic and imported rock was 1,856,245 tons.

Plant prices were mantained at a fairly uniform figure compared to 1930, with no serious evidence of disastrous price cutting although there were indications that some producers had absorbed the recent increase in freight rates when quoting prices on gypsum products.

Developments in the industry in the United States during the year were confined largely to the improvement of previous products. A number of new products were introduced, however, among which are a product of unusual hardness used for mastic floors, tongue-and-groove floor tile over which any form of floor topping may be used, a plaster board faced with real wood veneer for paneling, and an insulating tile board.

With the exception of a panel plaster board, which was described in ROCK PRODUCTS January 9, these new products were in most cases of minor importance as regards tonnage. It is estimated that the use of finely ground crude gypsum and dead-burned gypsum as fillers in paper represents a market for approximately 500,000 tons annually.

The United States Gypsum Co. improved two of its plants; plant gas-burning equipment replaced coal-burners at Fort Dodge, and grinding equipment for the manufacture of terra alba was installed at Alabaster. The Arizona Gypsum Plaster Co. started up an open-cut mine acquired during the year.

IMPORTS AND SALES OF GYPSUM AND GYPSUM PRODUCTS IN THE UNITED STATES IN 1931, AS REPORTED BY OPERATORS

	1st quarter	2nd quarter	3rd quarter	4th quarter
Number of operators reporting	33	35	34	34
Crude gypsum mined, short tons	545,018	851,082	640,068	482,930
Crude gypsum imported (as reported by importers), short tons	*	156,448	303,784	148,536
Crude gypsum sold (domestic and imported), short tons	126,543	262,841	234,938	150,920
Calcined gypsum produced from domestic and imported rock, short tons	444,116	578,621	493,552	339,956
Calcined gypsum products sold from domestic and imported rock:				
For pottery, terra cotta, plate glass, mixing plants, etc., short tons	54,921	51,993	44,010	32,797
Keenes cement, short tons	7,894	7,658	6,990	4,736
Neat, wood fiber, sanded, gaging, finished plasters, etc., short tons	302,237	410,942	373,808	250,327
Wall board, sq. ft.	88,569,846	105,129,361	72,122,523	62,795,565
Plaster board and lath, sq. ft.	53,873,521	65,925,953	56,525,903	41,148,058
Partition tile, sq. ft.	6,052,441	7,016,019	5,315,636	3,435,911
Other calcined gypsum sold, short tons	3,427	3,376	3,313	2,093

Economics of the Nonmetallic Mineral Industries*

Part XIV—Combinations and Consolidations

By Raymond B. Ladoo

Recently Manager of the Industrial Commodities Department, United States Gypsum Co.

THE TENDENCY of the times is strongly toward combinations and consolidations. The changed economic conditions throughout the world, caused by the world war, brought problems which could not be successfully solved by small individual producers. This probably would have been an inevitable result of the dynamic progress of the machine age, but the war certainly hastened it. The need for tremendous mass production of war materials forced the growth of huge industrial machines and the development of efficient, rapid, large-scale production methods. The close of the war left us with excess plant capacity in many industries and with a host of men trained to think in terms of mass production. The day of the small "one man" business was gone forever, except in minor or highly specialized lines.

While the needs of the times suggested and even demanded the formation of larger companies by consolidations and combinations, yet the underlying motives which actually brought them about have been many and varied. Some of these are:

1. Too great competition, forcing prices down and making companies unite to reduce costs and increase prices.
2. Insufficient capital in small companies to enable proper modernization of equipment.
3. Manufacture and sale of a single product in a limited area, resulting in too high sales cost and too limited a number of shipping points to reach a wide market on a reasonable freight rate.
4. The desire by financial and investment houses to form large corporations, not only to have securities to sell to an investing and speculative public, but also to obtain for their promotional services large amounts of stock, to hold for dividends or to sell for cash at an opportune time.
5. The large earnings of some of the stronger companies gave them cash surpluses for which they sought profitable investment, by buying up smaller organizations.
6. Strong competition, mass production, large volume of business and small profit per unit sale forced the utmost manufacturing economies. The purchase of smaller companies, producing necessary raw materials, helped make for lower costs.
7. The larger and more powerful the stronger companies grew, the greater their manufacturing economies and the lower their selling costs. This made conditions progressively harder for the small producer and forced him to sell out or to merge with other small producers.
8. Low selling costs are made possible by national advertising, but this also means national distribution, which in turn makes necessary large-scale production in numerous and nationally distributed plants.

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Editors' Note

IN this article the author discusses the types of combinations, vertical and horizontal, and the reasons for their formation.

He also describes the manner of their formation and the information and data collected in order to determine their soundness.

—The Editors.

While the entire trend of the times is toward large corporations, and away from sole proprietorships, partnerships, and small corporations, yet it may be worth while to examine the advantages and disadvantages of each.

Small-Scale Operations

1. Owners are usually the chief executives and take a personal interest and pride in the success of the enterprise. Salaried executives may not take the same interest.
2. Small organizations are more compact and flexible and can more easily make specialized products to meet customers' needs. They can move more quickly and more directly toward their goal.
3. Small producers are on more intimate terms with their customers, and can often hold valuable business through friendship.
4. Unless unusually well managed and exceptionally successful, most small organizations do not have adequate capital to expand and modernize their plants to keep pace with their larger competitors.
5. Sole proprietorships and partnerships have no means of increasing their capital except from personal sources, and the small corporation usually lacks the public recognition and confidence essential to modern and large-scale financing. If they must have money they are often the prey of unscrupulous promoters.
6. Proprietorships and partnerships have no permanence, and either death or incompetency through age or other disability necessitate a change in organization.
7. Small organizations seldom have the reserves necessary to weather a severe competitive price war or a general business depression.
8. Small-scale operations do not permit the employment of experts and specialists, and the decisions of the managers are correspondingly less accurate than the decisions made by the management of large organizations.

Large-Scale Operations

1. Large organizations are invariably corporations, which have the advantages of permanence, and to a very great extent a stability of management and a continuity of general policies.
2. Through profit-sharing arrangements or bonus plans, the personal interest of the management of a large corporation may be stimulated to a point where their efficiency and accomplishments are equal to if not greater than in the small-scale operation.
3. Large organizations have the funds necessary to carry on experimental work, develop markets and carry on other activities that contribute to the creating of new and improved lines, and the sales outlets necessary for their profitable handling.
4. Large companies suffer from an excess of "red tape," which is often necessary to make such large organizations function. If used properly, however, this situation is conducive to a certain amount of internal control that is desirable.
5. The personnel of large organizations do not usually build up or maintain the close friendly relationships with the trade possible in the small organizations.
6. Large organizations are able to increase their working capital and plant facilities by public financing through stock or bond issues, and so are afforded the opportunity of rapid expansion.

Types of Combinations

There are two general types of large combinations, so-called vertical and horizontal integrations.

A vertical combination is one in which a company seeks to make itself independent by producing all or a major part of its raw materials, by owning its own transportation lines and so on. The Ford Motor Co. is a good example. This company has its own iron mines, blast furnaces and steel mills. Its blast furnace slag is made into portland cement for its own use (with a surplus for sale). Its blast furnace coke is made in by-product coke ovens, from its own company-mined coal. The coke oven gas is utilized in the plants and byproducts, such as ammonium sulphate, are sold. Many other activities are carried on in the same way, with the ultimate goal of making automobiles cheaply in large quantity.

In a horizontal combination a company

grows by adding more plants of the same type in other locations, without making much effort to produce its own raw materials (other than those basic to its product) or to expand into other lines. The International Cement Corp. and the Lehigh Portland Cement Co. are examples of horizontally integrated companies. Both produce portland cement as their only product, or practically so. They have many cement plants in widely separated localities, but do not attempt to mine their own coal or gypsum nor to make their own paper bags.

There are many companies, particularly some of the huge modern organizations such as the du Pont Co., which are integrated both horizontally and vertically. They expand both by adding other plants to produce their primary products and by going into allied or even not closely associated fields.

Many companies grow horizontally until they are about as large as they can be economically or without being considered monopolies, and then further growth has to come by growing vertically or in parallel, vertical and horizontal directions in other industries. The United States Gypsum Co. is an example of this type of growth. It reached a point where further growth in the gypsum industry would have had to be slow, and then it began to branch out. It now makes paper for its own use (wallboard covering) and lime for use and for sale. It has a paint products division which is expanding, a rapidly growing metal lath division, an insulation (both gypsum and non-gypsum bases) division, and so on.

How Combinations Are Formed

Everyone knows that new combinations are continually being formed, but few people are familiar with what caused them, how they were actually brought about, who conceived the plans, and who was the guiding force behind them.

Probably today more consolidations are brought about by bankers and promoters than in any other way. Investment banking houses must have new securities to sell, as securities are the commodities of their business. New securities arise from (1) refinancing old companies; (2) founding new enterprises; and (3) forming consolidations and combinations. The first and third sources of securities are favored by most sound bankers. The second source, that is, from starting new enterprises, is too speculative for conservative bankers (except as private, personal speculation) and is usually handled by promoters. Some consolidations strongly savor of speculative promotions and are handled by promoters or by some of the promoter types of so-called investment houses.

The banker type of consolidation often happens something like this. An investment banker hears that a certain industry is in a more or less chaotic condition. He investigates and finds a dozen or more competing companies of small or moderate size, and immediately visualizes a huge corporation. He or an associate visits each of these companies, gets all the necessary data about them, and, depending upon the nature and peculiarities of the man he is dealing with, offers to buy the company or suggests a merger, or in some other way ties it up on an option or on some definite basis. Some are flattered, some are persuaded, some are mildly frightened into the project, until a sufficient number have been tied up to assure a consolidation of considerable size. A corporate structure is decided upon, the corporation formed, and securities are issued, part being retained by the bankers for their promotional services. The investment house, either alone or with several other friendly houses, underwrites the issue and the sale of securities is begun. Some of the companies are bought outright for cash, some for part cash and part stock, and some exchange their stock for stock in the new corporation. Very often bonds of the new company are issued to some of the companies joining in the consolidation, in full or part payment for their properties.

Usually the capitalization of the new company is far in excess of the total capitalizations of the constituent companies, often several times, and the bankers keep a very generous share. The stock may be sold at par but is often put out at a discount. Salesmen's commissions must be paid. The discount may be as low as 5 or 10% or as high as 50%, depending on the honesty and conservatism of the banker, the attractiveness and salability of the issue, the condition of the money market, and so on. Many such organizations are doomed to failure at the start by over-capitalization and too small a percentage of cash from the sale of stock actually going into the business. On the other hand, banker-promoted consolidations may be very sound and successful, if carried out by honest, able and conservative houses.

Promoters handle consolidations in much the same way, except that they usually are less conservative, do their work less thoroughly, and do not have such sound established channels for the sale of securities as investment bankers. They may sell stock themselves or through a temporary sales force, or they may turn the whole project over to an investment house for a definite commission in cash, stock, or both.

Consolidations often start with the producers themselves. Their industry may be in poor condition and they may get together to consider some form of relief. A merger may be the answer and a committee may work out the details of a plan and put the whole project through. Outside financing may or may not be needed.

Perhaps the industry may not be in such bad condition but one keen, progressive, farsighted individual in it may see great possibilities for profit by consolidating scattered, local, competing companies into one strong national organization. Usually a successful consolidation does have one outstanding energetic man behind it who does most of the work.

Collection of Required Information

Where a reorganization or merger or consolidation requires financing, especially by investment bankers, considerable data must be assembled to justify the securing of the needed funds and to testify to the soundness of the project. The soundest and most conservative bankers require all of the following information about each company, and perhaps much more:

1. Audit of all accounts by certified public accountants, and the preparation by them of
   (a) Statements of annual earnings covering a period of at least five years; the longer the better.
   (b) Balance sheets at the end of the period covered by the earnings statements, and usually at the beginning of the period also.
   (c) A consolidated balance sheet of all companies joining in the proposed merger, giving effect to the proposed financing and consolidating transactions.
2. The appraisal of all properties by competent appraisers or engineers.
3. Search of all titles to properties represented as being owned by the participating companies.
4. Examination by lawyers of the corporate records of each company, to insure the legality of each step taken in the merger.

In addition to this information a general study is, or should be, made of annual consumption, markets, prices, seasonal fluctuations, trends of the industry over a period of years, amount and kinds of competition both within and outside the industry, and so on. From this data a reasonable estimate of future prices, volumes of business, probable profits, etc., can be made, giving effect, also, to the economies of operation or other advantages which may be reasonably expected as a result of the consolidation. All of this data should be assembled, prepared and interpreted by competent engineering, financial and legal talent and checked by a man familiar with the industry.

While all of this information is essential to obtain an adequate idea of the soundness of the project, unfortunately sufficient time, money and trouble are not always taken to get the full story. Less scrupulous promoters, concerned chiefly with immediate profits from the sale of securities rather than with the soundness of the investment and the future earning capacity, get a quick picture and base their statements on hope rather than fact. Every type is found, from the soundest, most careful preparation of data by strong bankers to entirely baseless and fraudulent misstatements by wild-cat promoters.

In some instances the represented tangible assets, records of earnings and other data on which the decisions are based do not tell the full story, or perhaps a company essentially sound and valuable may have been in business too short a time to have established

its position in the industry and to have built up an earnings record indicative of its potential strength and importance. Perhaps three or four competing companies have been through a long price war, so that none of them individually has made money, whereas a merger of these interests could be made highly profitable. Sometimes intangible assets such as trade names, good will, patents and so on are far more valuable than mineral deposits, real estate, machinery and equipment. If a complete study of the type outlined is made, these facts will be brought out. Values can be ascribed to intangible assets by capitalizing the earnings in excess of a normal return on the net tangible assets, and a capital structure for the merger based on the requirements or demands of the owners of the individual companies can be set up.

Prices to be paid for individual companies or properties will be determined, partly as a result of bargaining and partly through a full consideration of the relative amounts of good will contributed, the value and physical condition of plants and other properties, and the manner of payment, i.e., whether in cash, bonds, preferred stock or common stock. The owners of one participating company may wish to retire from business and want cash for their interests, while the owners of another company may intend to continue in positions of active management in the new consolidated company and be perfectly willing to accept common stock for their equities. Under other conditions either bonds or preferred stock of the new company may be issued to some of the participants in the merger.

Another type of asset not commonly taken into consideration, but extremely important, is man-power—organization—personnel. A strong, capable, satisfied organization is often more valuable than a fine plant or a patented process. Good men can make even a fair project profitable, but a weak organization will make a failure of even the best company. The most able and successful men in the business world recognize this fact and are at least as much concerned over who is at and near the top of a company as what the company has in physical assets.

Research is another factor not often appraised, but an able and productive research department is a very real and tangible asset. Some of the large companies which have such research departments value them above their physical plant and equipment. A good research department can create wealth by discovering new materials and new processes and by developing new machines and methods. Such items as organization and research perhaps cannot be properly evaluated in dollars and cents, but they have a very powerful effect on the success and earning power of a company.

(To be continued)

Crushing and Grinding Limestone at the Howes Cave, N. Y., Plant of the North American Cement Corp.*

By W. J. Fullerton and Albert W. Cox†

THIS is one of a series of papers giving direct operating costs of crushing and grinding materials for cement manufacture. High calcium limestone is crushed and clay and cinders are added at the grinding mills. The grinding is done wet to a fineness of 90% through 200 mesh.

The primary crushing is done in a 48-in. by 60-in. Allis-Chalmers jaw crusher, belt driven by a 200-hp. motor. The crusher is located in a pit, with its top a little below the level of the quarry floor. In placing cars at the crusher the train is pushed through the crusher building on to a slight incline beyond. As needed, the cars are dropped to the crusher by gravity, and the car to be dumped is stopped at the proper point by a Link-Belt compressed-air car retarder. When in action the plates of this retarder, lying along the inner sides of the rails, are pressed against the flanges of the car wheels and thus act as brakes. The stone is dumped from the side-dump cars by means of a Shephard electric hoist and cable.

A Stephens-Adamson apron feeder, 54 in. wide by 15 ft. long and driven by a 10-hp. motor, carries the stone from the jaw crusher to the hammer mill, located on the floor of the crusher pit. This is a Pennsylvania hammer mill with 48-in. hammer circle and is driven directly by a 350-hp. induction motor at 900 r.p.m. It receives minus 9-in. stone and delivers minus 2-in. stone. A 36-in. belt bucket elevator and a 36-in. by 210-ft. inclined belt conveyor carry the stone from the hammer mill to two Hum-mer electric vibrating screens equipped with 48-in. by 60-in. sections of ¼-in. by ¾-in. ton-cap wire cloth. The minus ¼-in. material from these screens falls to bins below and the oversize is spouted to other bins from which it is fed by Smidth table feeders to three Williams No. 3 hammer mills, belt driven by 100-hp. motors at 1040 r.p.m. These mills receive minus 2-in. stone and deliver minus ¼-in. stone, which is carried to the fine stone bins mentioned above by means of 12-in. screw conveyors and a 14-in. belt-bucket elevator. The Williams mills probably crush about 38 tons per hour each.

At this point the clay and cinders are added, the mix being about 85% stone, 11% clay and 4% cinders, and the mixture is ground with water from minus ¼-in. size to 90% minus 200 mesh. The stone and clay are fed by 20-in. Schaffer poidometers and the cinders by a Smidth table feeder. A 12-in. screw conveyor carries the mixture to two ball mills.

Grinding

The ball mills are Hardinge conical mills, 8 ft. in diam., one 36 in. long, the other 48 in. long between cones. Each is loaded with 44,300 lb. of balls and is driven by a 200-hp. motor at 17½ r.p.m. Each mill is equipped with a screen of 12-mesh wire cloth. The oversize from these screens is elevated and returned to the mills for regrinding. The ball mills reduce the material from minus ¼-in. to 90% minus 20-mesh. The water content of the material leaving the mills is about 28%. The average output is 23 tons per machine-hour (on dry basis).

The material leaving the Hardinge mills flows through a nearly horizontal mechanically agitated trough to the tube mills. Six small tube mills and one large tube mill are on a level below the ball mills, so that their feed comes to them by gravity. One large tube mill is located on the same level as the Hardinge mills, and is fed by a belt-bucket elevator. There are six Abbe trunnion tube mills, center discharge, 5-ft. diam., and 21 ft. long, and two Smidth tube mills, peripheral discharge, 6½-ft. diam. and 21 ft. long. The tube mills reduce the material from 90% minus 20-mesh to 90% minus 200-mesh. More water is added at the feed end of the mills, so that the slurry leaving the tube mills contains about 32% of mois-

*Abstract of U. S. Bureau of Mines Information Circular 6553.

†Consulting engineers, U. S. Bureau of Mines, and engineers, North American Cement Corp.

ture. The average output (on dry basis) is about as follows: Abbe mills, 4.7 tons per mill-hour; Smidth mills, 15.4 tons per mill-hour.

The slurry from the tube mills discharges into pits, whence it is pumped by centrifugal pumps to the storage tanks. After mechanical and compressed air agitation and mixing in the tanks, it is fed to the rotary kilns in which it is burned to cement clinker.

Personnel in Crushing and Grinding Departments

The division of labor is indicated in the following tabulation. The figures are based on two-thirds full operation, for although the cement plant is a 3-kiln plant, only 2 kilns are normally running. The general mill foreman has supervision of these departments.

LABOR FOR CRUSHING AND GRINDING

	Men per shift	Number of shifts	Hours per shift	Man-hours per 24 hours
Operating jaw crusher, dumping cars, etc.	1	1	9	9
Operating Pennsylvania hammer mill, oiling, tending chutes, etc.	1	1	9	9
Operating Hardinge ball mills and Williams hammer mills	1	2	8	16
Operating 8-tube mills, pumps, unloading cinders, cars, etc.	1	2	8	16
Clay-bin and clay-belt attendant	1	2	8	16
Repairman	1	1	9	9
Total man-hours per 24 hours	--	--	--	75
Approximate man-hours per ton of material (dry basis)				0.125

The figure of 0.125 man-hours per ton of material (dry basis) is approximate, based on the tabulation that precedes it with its total of 75 man-hours per 24 hours and on a tonnage of 600 tons crushed and ground per 24 hours. This figure is based on 2-shift operation, at which time 2 kilns are operated burning 2000 lb. in 24 hours and using 600 lb. of dry material per bbl. For 3-kiln operation and 3-shifts the man-hours per ton would be slightly less, for the jaw crusher and hammer mill would still operate during only 1 shift.

Consumption of Hammers, Balls and Linings

The following figures are based on experience for the full year 1930 when 181,400 tons of stone were crushed:

	Ball mills (Hardinge)	Tube mills (Smidth)	Tube mills (Abbe)
Diameter and length of mill	8 by 3 and 4 ft.	6½ by 21 ft.	5 by 21 ft.
Total pounds of balls used in 1930:			
4 and 5-in. forged-steel balls	26,400	.....	.....
⅞-in. round iron balls	.....	193,217	.....
Danish flint pebbles	.....	.....	81,813
Ball consumption:			
Per mill-hour, lb.	2.87	22.26	4.89
Per ton ground, lb.	0.124	1.442	1.041
Cost of balls per ton ground	.....	$0.0575	$0.0110

Manganese-steel hammers used in Pennsylvania hammer mill:

Total hammer sets	3½
Sets per 100,000 tons stone	1.93

Manganese-steel hammers used in Williams No. 3 mills:

Total hammer sets	5½
Sets per 100,000 tons stone (approx.)	4.05

Grinding-media consumption:

Type of lining plates used in Hardinge mills	Titanite steel
Number of plates used	140
Cost of plates used	$1,070
Type of lining used in Abbe mills	Adamant silica brick
Pounds brick used	63,000
Cost of brick used	$787

Tonnage figures are on a dry basis. Total tons, 212,500, distributed as follows: Stone, 181,400; clay, 23,400; cinders, 7,700.

Crushing and Grinding Cost

The cost of crushing 181,400 tons of dry stone in a jaw crusher and hammer mill from minus 4-ft. to minus 2-in. during 1930 was as follows:

	Cost per ton
Labor	$0.0192
Supplies	.0258
Electric power	.0076
Total	.0526

The following table gives the cost of crushing the dry stone in 3 Williams hammer mills, and of grinding the mixture of stone, clay, and cinders in Hardinge ball mills and Smidth and Abbe tube mills (with 32% of water), from minus 2-in. to 90% minus 200-mesh, 181,400 tons of stone, 23,400 tons of clay, 7,700 tons of cinders, 212,500 tons of mixture:

	Cost per ton
Labor	$0.0793
Supplies	.0851
Power	.0826
Total	.2470

Electric power is made in the company's power plant, using boilers operating on waste heat from the cement kilns, but a small quantity is also purchased. The average cost of power per kilowatt-hour, including that generated and purchased, for 1930, was $0.004.

Tests Effect of Hot Cement

CAREFUL TESTS in building the six-mile Dunes Relief Highway, in northern Indiana, indicate virtually no differences in workability, strength, volume change, checking or cracking of paving concrete due to the use of hot cement of plus 180 deg. F. temperature.

The tests were a part of an investigation being made by a subcommittee of the cement committee of the American Society for Testing Materials as the result of requirements in the specifications of some state highway departments that cement when delivered on the job must not be above 125 deg. F. in temperature. At the meeting of the society in July, 1931, a recommendation was adopted that, pending the conclusions of the committee, the limiting clause be not used. The Indiana tests are the first results made public of any part of the subcommittee investigations.

A recent report of these tests in the *Engineering News-Record* says that from the observation of conditions that obtained during this investigation it would seem that weather conditions were responsible for such impaired workability as occurred rather than cement temperature.

The compressive strength of the hot cement concrete, as indicated by 6x12-in. cylinders, was slightly greater at 7, 14 and 28 days, but at the age of three months it was essentially equal to that of the cold cement concrete. Cores drilled from cold-cement concrete were slightly stronger in comparison with those drilled from hot-cement sections.

The volume changes that occurred in the sections of cold and hot cement did not differ sufficiently to warrant a distinction.

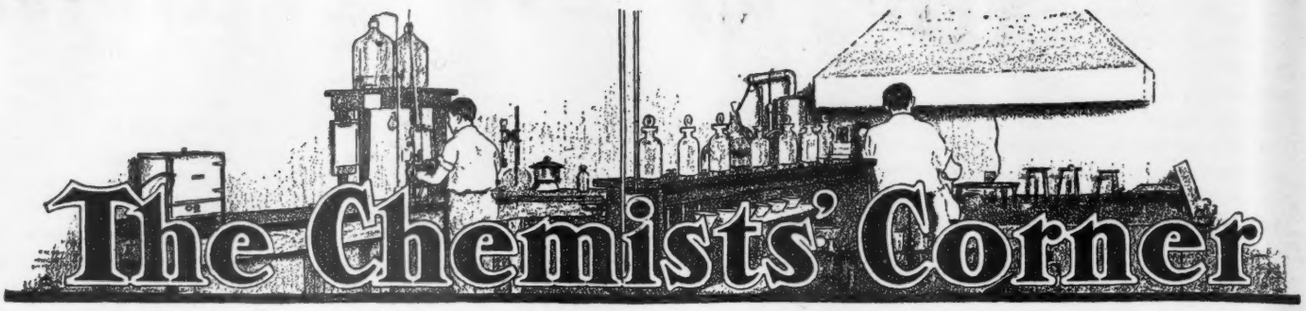
The effect of the hot cement was to reduce to some extent the modulus of rupture. These results of the study of flexural strength indicate that the use of hot cement may be slightly detrimental to this property of concrete, especially at early ages.

Canadian Cement Production

THE DOMINION Bureau of Statistics at Ottawa reports that the sales of cement in Canada during December, 1931, amounted to 370,672 bbl.; the preceding month's total was 801,040 bbl., while the December, 1930, production was 393,355 bbl. Sales during the calendar year 1931 totaled 10,161,658 bbl. or 7.9% below the 1930 production of 11,032,538 bbl.

PRODUCTION OF PORTLAND CEMENT IN CANADA

Month	1929, bbl.	1930, bbl.	1931, bbl.
January	385,679	270,702	343,975
February	430,710	297,466	417,515
March	581,815	451,396	607,872
April	796,475	786,111	835,769
May	1,233,644	1,213,307	1,090,449
June	1,579,163	1,321,036	1,242,864
July	1,669,915	1,512,929	1,111,253
August	1,697,090	1,475,163	1,118,482
September	1,447,387	1,410,620	1,086,428
October	1,423,489	1,186,810	1,135,339
November	760,083	713,643	801,040
December	278,631	393,355	370,672
Total	12,284,081	11,032,538	10,161,658



Notes on the Determination of Flour in Cement

By Eduardo Taylor
Chief Chemist, Cebu Portland Cement Co., Cebu, P. I.

IT IS WELL recognized that the portion of cement called "flour" is the active and strength-producing fraction. No one has been able to state definitely the size of these particles. Pearson and Sligh[1] considered particles of 0.001 in. (25 microns) diameter and under as flour. On the other hand, Wright[2] advances the opinion that "the particles in a cement which are finer than a 10-micron size probably hydrate so rapidly that they are spent before the mixing of the mortar is completed, thereby losing much of their efficacy as cement." The latter appears to be a reasonable supposition and gives us a basis for understanding the seemingly erroneous results obtained by some investigators wherein the finest cements did not always give the highest strengths. The writer proposes, therefore, to designate as "flour" those particles of a cement whose diameters are between 10 and 25 microns.

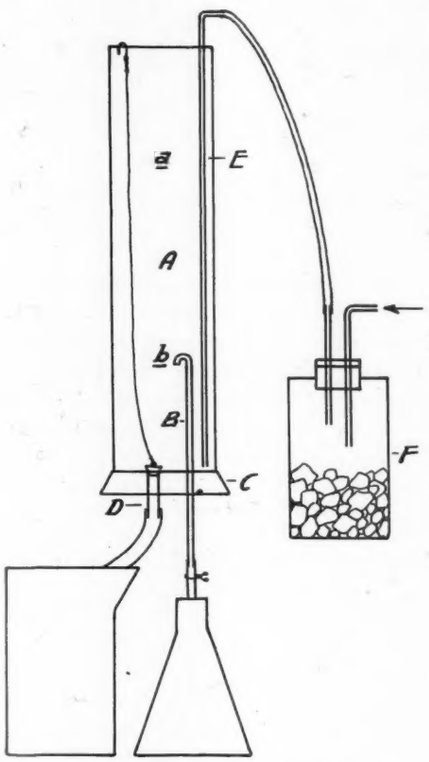
There are several types of apparatus for the determination and separation of the flour in cement. The reader is referred to the valuable paper by Pearson and Sligh on this subject. Recently, F. L. Smidth and Co., New York, and Federal Pneumatic Systems, Inc., Chicago, have each placed on the market a laboratory separator. Not all cement laboratories are equipped with apparatus of this kind.

Simple Home-Made Apparatus

The following description of a simple home-made sedimentation apparatus, its calibration, and operation may be of interest.

The apparatus is extremely simple and may be constructed from odds and ends found in a laboratory. It is best described by reference to the sketch.

A is a cylindrical glass tube 14 in. long and 2 in. in diameter. These dimensions are not important and may be altered. *a* and *b* are marks on the cylinder and are exactly 20 centimeters apart. *B* is a small glass tube going through the rubber stopper *C*. The end of *B* that extends into the cylinder is curved as shown and the opening place exactly level with the mark *b*. To the lower end of *B* is attached a short piece of rubber tubing and a pinchcock. *D* is another glass tube about twice the diameter of *B*. It also passes through the rubber stopper *C*, its upper end being flush with the top of the stopper. The upper opening of this tube *D* is closed by a small cork or rubber stopper having a piece of wire or string attached to it and which is used for opening the tube *D*. *E* is a glass tube extending to the bottom of the cylinder *A* and delivers the air used for agitating the contents of the cylinder. The air is previously dried by passing through the bottle *F* which contains pumice stone drenched in strong sulphuric acid. The air supply may come from a blower or a compressed air line. The cylinder *A* is best held upright by means of a tripod stand fitted with a condenser clamp.



Sedimentation apparatus used for flour determination

Operation of Apparatus

A weighed quantity of the cement to be tested (5 grams is a convenient quantity) is carefully introduced into the cylinder *A*, taking care that during the introduction of the sample no dust is lost. The cylinder is then filled with absolute alcohol to the mark *a*. The air is turned on and so regulated that sufficient agitation is produced without any spilling of the contents of the cylinder. After several minutes the air is shut off and the cement allowed to settle for an exact period of time using a stopwatch. The time of settling will depend on the calibration of the apparatus as explained below. After settling the required number of minutes and seconds, the pinchcock on the tube *B* is opened and the cement-alcohol mixture is received in a suitable container. The flow will automatically stop as soon as the level *b* is reached. The process is repeated until the liquid above the mark *b* is practically clear after the settling period. A beaker is then placed below the cylinder, the remaining liquid agitated for a short while and the wire *e* pulled to open the tube *D* through which the liquid will pass into the beaker. Any cement remaining in the cylinder is removed by pouring small portions of alcohol into the cylinder. The contents of the beaker are then filtered through a Gooch crucible packed with asbestos, using suction, and after drying thoroughly in an oven the weight of the cement residue is determined.

This weight deducted from the weight of the original sample will give the weight of the flour the percentage of which may then be readily calculated.

In accordance with the views given in the first paragraph of this article, the writer makes two separate determinations, one for obtaining the percentage of particles 25 microns and under and the other for obtaining the percentages of 10-micron particles and under. The difference between these two results gives the percentage of desirable flour. All of the alcohol used is recovered by distillation.

Calibration of Apparatus

The most accurate method of calibrating the apparatus would be by direct microscopic measurements. But three-dimensional microscopic measurements require considerable skill and experience which are not always available in plant laboratories. As an alternative, the application of Stoke's Law affords a simple and quite accurate method of calibration.

Stoke's Law may be expressed by the following formula:[3]

$$V = \frac{2 g a^2 (\sigma - \rho)}{9\mu}$$

where

V = the terminal velocity in cm. per sec.
g = the acceleration due to gravity = 981 cm. per sec.[2]
a = the radius of the particle in cm.
σ = the density of the falling body in grams per cm.[3]
ρ = the density of the fluid in which the body is falling, expressed in grams per cm.[3]
μ = the viscosity of the medium expressed in C.G.S. units.

By applying Allen's formula[4] we find that Stoke's Law holds good for cement particles in alcohol as long as the diameter of the particles is not greater than 126 microns. It appears, however, from some experiments made by the writer that Stoke's Law breaks down at a critical diameter of about 70 microns. The experiments made consisted in comparing fineness results obtained with the use of standard sieves and the apparatus here described. As testing sieves are obtainable up to 325 mesh (44 microns), this apparatus and other flour analyzers would only be used for determinations under 44 microns and one may be fairly confident of the accuracy of Stoke's formula.

By substituting in the formula the various known quantities, we solve for the value of V in terms of centimeters per second. Since the distance of settling in the apparatus described is 20 centimeters, the time of settling to be used will be $\frac{20}{V}$ seconds. For the convenience of the reader, the values of the various factors in the formula are given below.

g = a constant = 981.
a = 0.00125 cm. for 25-micron particles.
= 0.0005 cm. for 10-micron particles.
σ = the specific gravity of the cement, usually 3.1.

ρ and μ vary with the temperature as follows:

Temperature deg. C.	Value of ρ[5]	Value of μ[6]
10	0.79784	0.0145
15	0.79360	
20	0.78934	0.0119
25	0.78506	
30	0.78075	0.00989
35	0.77641	
40	0.77203	0.00827

In his work the writer uses a settling time of 4 minutes and 2 seconds for the determination of particles 25 microns in diameter and under, and a settling time of 26 minutes and 6 seconds for particles 10 microns and under. The cement dealt with was found to give the following results in one case:

Minus 200 mesh = 87.0%.
Minus 25 microns = 47% = total flour.
Minus 10 microns = 28% = ultra fines.
Minus 25 plus 10 microns = 19% = desirable flour.

It appears from the above results that the particular cement tested had 19% of flour between the 25- and 10-micron size range. This seems to be a very small quantity if we are to accept the supposition that ultra fine flour (minus 10 microns) is not very desirable. This particular sample of cement, however, is of a high quality and gave the following tensile strength (U. S. specifications):

1 day = 231 lb.
3 days = 293 lb.
7 days = 361 lb.
28 days = 465 lb.

If such strengths are possible with 19% of the desirable flour, one can readily see the great possibilities of much higher strengths from increasing the flour content and without resorting to chemical alterations.

Results with the apparatus described can be duplicated to within 1%.

References

[1] Pearson and Sligh, Bureau of Standards Tech. Paper No. 48.
[2] Wright, Rock Products, December 20, 1930, 48.
[3] Martin, Treatise on Chemical Engineering, London, pg. 30.4
[4] Loc. cit., pg. 30.5.
[5] Circular 19, Bureau of Standards.
[6] Martin, Loc. cit., pg. 7.13.
Gaudin, Groh and Henderson, *Ind. and Chem. Eng.*, December, 1930.
Kuhl, *Cement and Cement Manufacture*, March, 1931.

Fineness and Sieving of Portland Cement

THE advantages of fine grinding and improved methods of determining the fineness of cement are given in an article by A. C. Davis, managing director of the Associated Portland Cement Manufacturers, in a recent issue of *Cement and Cement Manufacture*, London, England.

According to Mr. Davis it has been definitely established that fine grinding gives higher strengths and greater sand-carrying capacity, and a more reliable and safer product. The present British standard specification for portland cement requires that not more than 10% remain on a British standard 170-mesh testing sieve. The fineness of the valuable particles, or "flour," is such that it is impossible to separate them into different sizes by sieving methods and machines known as elutriators have been developed.

The standard elutriator used in the plants of the Associated Portland Cement Manufacturers is of the down-blast type with the air blowing into the apex of an inverted cone. The tube above this cone is 4 in. in diameter and 4 ft. long. In making the test to determine the percentage of flour, air is blown through a 33.3-gram sample for 25 minutes and the residue is then weighed, the difference being the flour removed. The air pressure is maintained at 41.5 in. of water, which is equivalent to an air velocity in the tube of 21 ft. per min. This velocity was adopted as that corresponding to standard flour of 0.01-mm. size. The quantity elutriated gives a direct measure of the fineness of the cement and a comparison of different cements can be made.

Cement Research

FURTHER studies of the constitution of portland cement are reported by L. T. Brownmiller and R. H. Bogue in the *Bureau of Standards Journal of Research* under the title "Systems $CaO \cdot Na_2O \cdot Al_2O_3$."

According to this report the x-ray method of identification and optical identification under the microscope are extremely difficult in the case of soda compounds in cement because of the very small amounts present and the similarity of the optical properties and diffraction patterns of the soda and other compounds.

Hence the determination of the nature of the soda compounds is based on thermal studies. The results of the present investigation are given, these indicating the necessity of additional study of the soda systems with the other components of cements in order to solve the questions involved.

Top Dressing with Basic Slag

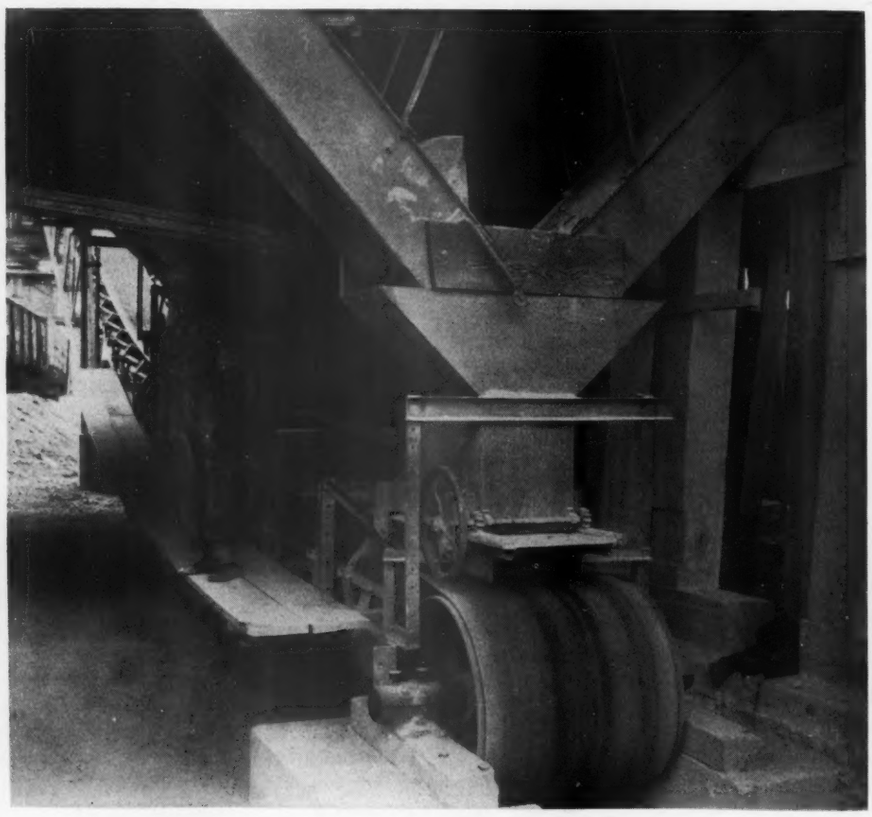
NUMEROUS results are given in a paper by A. Wilhelmj and E. Goepfert showing the value of basic slag as a top-dressing fertilizer for grain crops. When harrowed into the soil three days after sowing the seed, basic slag was as effective as an equivalent amount of superphosphate in increasing the yield of barley. In 25 experiments with winter grains basic slag gave an average increase in yield of 13.8% when used as a top dressing but not worked into the soil, whereas the increase amounted to 25.0% when the slag was applied as a top dressing and worked into the soil. The importance of bringing the slag into intimate contact with the soil moisture is emphasized.—*Chemical Abstracts.*

Hints and Helps for Superintendents

Gates for Feeding Crushed Stone

AT THE PIXLEY PLANT of the Stewart Sand and Materials Co., Kansas City, Mo., a system was installed at the loading bins so that blended aggregates could be shipped. While this is not particularly new in other localities, this company at the time was the only one in the Kansas City area that could ship such a product.

The crushed stone is drawn from the old bins to an inclined belt conveyor that serves the loading apron. The belt was simply mounted under the bins in one of the passageways that was formerly used for car loading, and two steel chutes were installed from each bin, as shown in the illustration, with a horizontal gate at each junction of the two chutes. The gate itself is similar to those used by the New York Trap Rock Corp. and has a V-slot cut in the horizontal portion so that small per hour tonnage can be fed if desired. By means of a hand wheel that actuates a rack-and-pinion the gate can be set to give any reasonable predetermined tonnage. For the larger sizes or even for the smallest sizes these gates work very satisfactory, but as an added precaution, the finer sizes (two sizes) are fed in predetermined amounts by two Hardinge measuring feeders that are mounted directly under the bins and deliver to the inclined steel chutes.



Feeding arrangement for preparing specification stone

Operates Shovel at High Altitude

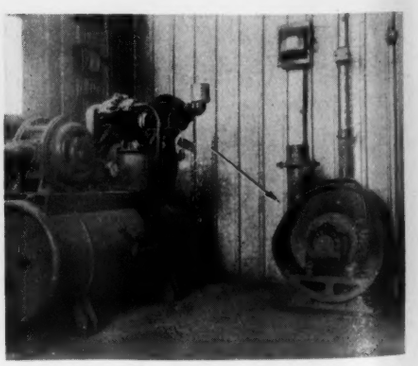
BUILDING an automobile road over Mt. Evans in Colorado required 30,000 yd. of excavation, 90% of which was gray granite. This job was 14,200 ft. above sea level, the highest elevation at which a gasoline driven power shovel has been known to work, and was handled by an Osgood Commander heavy duty shovel powered with a standard, "low altitude" six cylinder engine. The work was completed in six weeks of two shifts, and done by the Colorado state highway department.

Photo by J. P. Webb

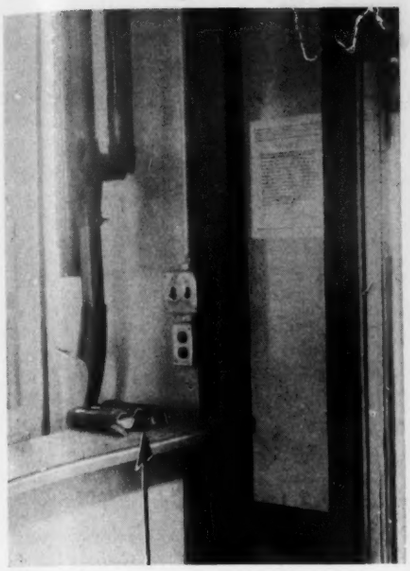
Operating with low altitude engine at 14,200 ft. above sea level

Handling Orders at Ready-Mixed Concrete Plant

THE SNAP and efficiency of a modern department store, at least that phase involving the transportation of written orders, currency, etc., has been adopted in ready-



Power unit for conveyor tubes



Department store methods used for handling orders

mixed concrete plant operations with notable success at the Central Concrete Mixing Corp., Brooklyn, N. Y.

Ready-mixed concrete plants often depend on hand signals, uncertain lights or even shouting to convey orders from the order clerk to the mixer operation. Each of these methods has objections and, if their use is continued, result sooner or later in a slip-up that not only loses a customer but reflects on the entire industry as well.

To insure a rapid and accurate delivery of orders from the office to the mixer operator, a Lamson pneumatic delivery system is used at the above-mentioned plant. This system only requires that the message be placed in the container and the container inserted in the air delivery tube, exactly as is done at many retail establishments. The air required for the tubes is supplied by an electrically driven, 16-oz. pressure fan which is located close to the office.

Oversize from second grizzly goes to crusher

Compound Grizzlies

THE LANDERS, Morrison and Christenson Co. of Minneapolis, Minn., has two large gravel plants close to that city and a crushed-stone plant as well. Its K and Broadway street plant is its largest producer and was acquired from the John Wunder Corp. The third plant was built originally by the Landers, Morrison and Christenson Co., at St. Louis, Minn.

At these operations, like many of the Wisconsin sand and gravel operations, the gravel is of glacial origin and contains considerable oversize material. Here and there are scattered through the bank boulders in excess of 16 to 18 in. in diameter, but the number of such boulders is not sufficient to justify a large primary crushing unit, as the bulk of the gravel pieces that require crushing can be reduced in a crusher that will receive a 16-in. stone.

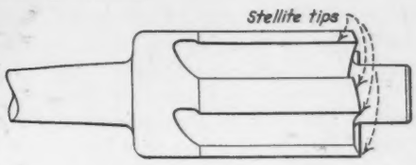
To separate the plus 16-in. gravel at this plant a horizontal rail grizzly has been built, to which the cars dump when they arrive at the plant. Any oversize that stays on this grizzly is hand sledged through the openings. Immediately below this grizzly is a second rail grizzly but spaced only at 4-in. centers. The oversize from the second grizzly falls to a Buchanan jaw crusher where it joins the fines from this 4-in. grizzly.

By this arrangement the large stone is kept at a place where it can be easily broken to a size that the primary crusher can work efficiently and at the same time scalps out the finer material from the primary feed so that a still more efficient crushing operation results.

Oversize at first grizzly is sledged through

Stellite-Tipped Tools

LACK of suitable tools causes frequent difficulties in machining or repairing machine parts of extra hard material, such as used in mills and crusher. Standard tools, not designed for work of this type, do not stand up, and loss of time and money results. To overcome this difficulty special tools must be obtained either direct from the factory, which is not always practicable because of the time required, or suitable tools must be made locally at a reasonable cost. An innovation in tool manufacture has recently been introduced by F. J. Martin, master mechanic, Miami Copper, Miami, Ariz. Tools made of common tool steel are equipped with carefully dressed and ground cutting edges of stellite. Cost of stellite for tipping the cutting surfaces is nominal; a 2½-in. special drill, shown in the accompanying illustration, was prepared for less than $4.—*Engineering and Mining Journal.*



A shop-made cutting tool

Rock Products Clinic

Safer Compressed-Air Receivers

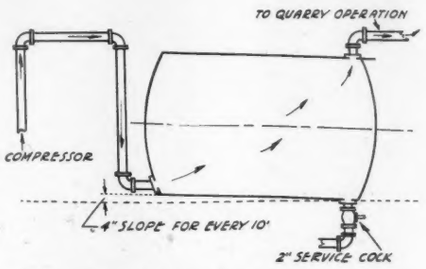
ONE of our editors visiting a quarry last summer noted an air receiver installation which experience told him was not safe—in fact, one very similar to that at the Stone Mountain quarry, Georgia, which exploded a few years ago, causing the loss of eight lives.

The matter was diplomatically called to the attention of the quarry operator, who was grateful for the suggestion. Referring to the article in Rock Products, July 4, 1931, "Air Receiver Installation and Care," by Walter B. Lenhart, this correspondent writes: "I note there are two illustrations of the way not to connect up an air receiver with only one setting up of the recommended design. The recommended design shows a vertical receiver. I presume there is an equally correct method of connecting up a horizontal receiver, such as we have."

Mr. Lenhart answered in part as follows: "In regard to the horizontal receiver I am not sold on that type of mounting at all and prefer the vertical method if at all possible to use it. However, if it is not conveniently possible to make a vertical mounting, the main thing is to have the locations of the inlet and the outlet so placed that as the air passes from the compressor to its ultimate destination, the receiver will be 'air-swept.' This will prevent the building up of any pockets of explosive gases.

"In your case I would suggest that you have your outlet at the top of the receiver and at one end, and that the inlet be located near the bottom at the opposite end. I would also mount the receiver so that it sloped slightly towards a drain valve located at the lowest point in the receiver. This valve should be a quick-opening service cock so that the operator could occasionally open it for a few seconds, allowing a large volume of air to expel itself and carry with it any accumulated scale or oily waste.

"I would also mount the receiver a reasonable distance away from the compressor itself. I say this because it has happened in the past that the compressor would be allowed to operate without any water passing over the valve and the valve would become red hot, and the accumulated carbon on the valve would become red hot and disengage itself and pass into the receiver. If this hot carbon came in contact with the oil or oily vapors, an explosion might result. By locating the compressor 15 ft. or more from the receiver, there might be an opportunity for the red hot carbon particles to cool off sufficiently to eliminate this hazard. This is a very rare case, but it has happened, according to the explosives experts at the Bureau of Mines who have investigated compressor explosions.



Recommended air receiver connections

"I did not notice whether your air receiver was an old boiler or not, but very often an old type tube boiler is used for a receiver with the tubes left in place, and I consider this type of mounting a distinct hazard, as the large areas of pipe in such receivers are excellent surfaces on which oil from the valves can collect and vaporize. I would certainly take the tubes out of the boiler and seal the head.

"The accompanying sketch of a horizontal receiver is along the lines suggested."

Against a Public Works Bond Issue

THE EDITOR: In your issue of March 26 you favor a United States bond issue to finance public works. You do not state the size of the bond issue which you advocate, but I presume you favor a bond issue of large figures.

In my opinion, this policy will be detrimental to all citizens of this country, including contractors and manufacturers of contracting equipment.

The government already has a very large volume of bonds outstanding. These bonds are largely held by the banks either as part of their reserves or as collateral.

It is generally admitted that the government will do a great deal of financing during the next few years, just to meet ordinary demands and to refund existing securities. It seems a bit doubtful as to whether government bonds can be maintained at par, even though the amount of new financing be kept down to the unavoidable minimum. But if we finance a large construction program through the issuance of bonds, it is absolutely certain that there will be a substantial depreciation of government securities.

The recent bank crisis was largely due to the depreciation of securities held by the banks. If the banks are subjected to an additional load, through a radical depreciation of government securities, this period of adjustment will be lengthened and conditions will become worse instead of better.

In my opinion your editorial voices a very short-sighted and one-sided viewpoint.

Charles F. Smith, President,
Smith Engineering Works,
Milwaukee, Wis.

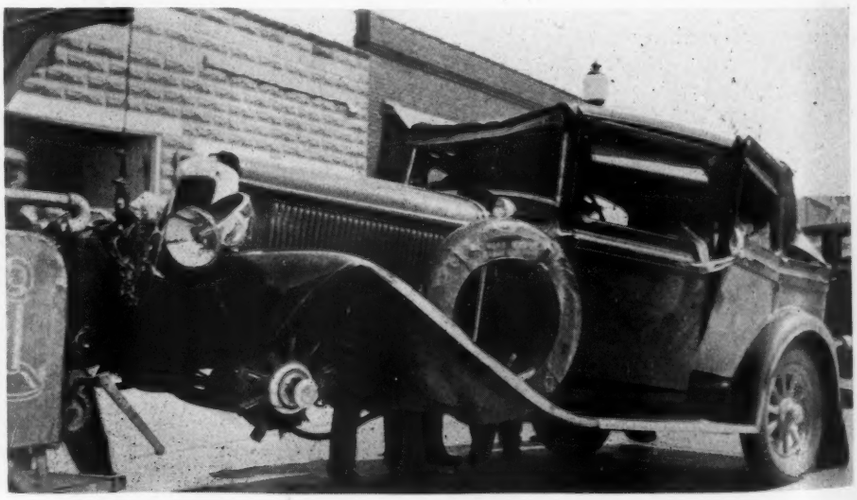
Speedy Rock Products Men Beware!

THE EDITOR: In regard to your letter inquiring progress on certain abstracts of foreign literature on portland cement . . .

To make matters worse in the way of delay, I met with a serious automobile accident last summer, and while I was not seriously hurt, I was shaken up quite a bit and injured the nerves in my right arm so that I did not have very much feeling in my right hand for several weeks, consequently I did not do very much writing.

The accompanying picture will give you some idea what happens when you get a flat going 55 miles per hour and are headed for a ditch. We turned over several times, and Mrs. Ernst sustained a broken collar bone and some minor cuts, but we were fortunate in not being killed outright.

Wm. A. Ernst, Chief Chemist,
South Dakota State Cement Plant,
Rapid City, S. D.



Result of flat tire when traveling at full speed

Editorial Comment

Federal Aid for Public Works Financing

There are two proposals before the United States Senate, on which a subcommittee of the senate has been holding public hearings. One is a federal bond issue of about $5,000,000,000 for public works; the other is to provide a way whereby the federal government would purchase local public works bond issues, for which at the moment there is practically no market. Adoption of either proposal would undoubtedly require the floating of a large federal loan or bond issue; and provision for interest on this loan would further unbalance the budget.

If the projects for development were properly selected, in the one case the principal and interest would be returned to the government in dividends of greater safety, comfort, health, happiness, and general well being of its citizens, as well as in lower costs of operation of many public services. In the other case the government would be reimbursed directly by the local public works authorities, having acted merely as a fiscal agency for such local authorities. The local authorities would of course get their return from the welfare and savings of their citizens. In either case the ultimate result is the same.

It is unpopular at the moment to oppose immediate balancing of the budget. Yet any sane business man who will look at the indisputable facts must admit that the pressure which has been and is being exerted to balance the budget is doing business a tremendous amount of harm, and is adding to the universal feeling of alarm at a very time when everything possible should be done to allay fears and restore confidence. When the speaker of the House of Representatives stated to his colleagues in his support of the sales tax that unless the budget was immediately balanced every bank in the country would suspend within sixty days, he was exaggerating beyond the bounds even of political expediency, and is contributing greatly to the creation of a real panic.

None of our vociferous budget balancers is willing to face the real facts in regard to government expenditures. These facts are that *only 8%* of our federal government expenditures are for its civil government functions, represented by the *bureaucracy* about which congressmen and business men are fuming. Nothing is said about the 38% of federal expenditures that pay for the military functions of the government. Nothing is said about the nonfunctional expenditures of the government amounting to 34%—refunds, losses, public war debt interest and retirement, etc. Savings that might be made in these two items totalling more than 72% of all government expenditures would make unnecessary any tremendous increase in taxation, and would provide for financing public works at a time when they are most needed.

Moreover, one good reason why municipalities and other public works authorities are unable to do their own financing may be laid directly to the widespread rebellion of taxpayers, frequently inspired and more often abetted by business leaders. It is true of course that some money designed for public works has been wasted by inefficient and dishonest administration. But we doubt if any larger percentage of such funds has been wasted than has been the case where an equivalent amount of money has been spent in business enterprises. The great bulk of public expenditures has been made for improved facilities which the public demanded and was entirely willing and glad to pay for.

So far as our own industry goes we know, and you know, that business men for entirely selfish and shortsighted reasons have frequently contributed to official inefficiency, incompetency, or worse. We are now all steamed up to use the present emergency "to clean house" and force reductions in public expenditures. The expressed object is laudable and no one can quarrel with any sincere attempt to obtain efficiency and economy in public administration as is being done in business management, but the effort should be intelligent and should be unqualifiedly honest.

There certainly should be a distinction between balancing current income with current expenditures, and balancing interest on permanent profit-making investments against current income. If it is logical and good business (or good government) for the United States treasury to help finance farmers, agricultural cooperatives, banks, railways, shipping, war veterans, etc., we see no reason why it should not help cities and other local authorities to finance public works of lasting and incalculable value and benefit to our citizens.

We heartily agree with *The Business Week* that "the only honest approach to the problems of governmental economy involves increasing the effectiveness of public administration by putting it on a strictly scientific basis under the management of competent officials who will be unconcerned with and incorruptible by the private business interests involved in every aspect of public activity. In the fiscal extravagance that exists, as well as the widespread racketeering that has become the curse of this country, business along with the public is paying the penalty of having constantly encouraged weakness in government or insisted upon keeping in office complaisant public officials to serve their special interests. We shall make no progress toward economy or honesty in public affairs until American business is willing to face these facts candidly and ask itself what it really wants."

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

Stock	Date	Bid	Asked	Dividend
Allentown P. C. 1st 6's[27]	4- 6-32	90	95	
Alpha P. C. com.[2]	4- 4-32	7¼	7½	25c qu. Apr. 25
Alpha P. C. pfd.[2]	4- 4-32	80	90	1.75 qu. Mar. 15
Amalgamated Phosphate Co. 6's, 1936[19]	4- 1-32	78	83	
American Aggregates com.[19]	4- 1-32	1½	3	
American Aggregates pfd.[19]	4- 1-32	8	15	1.75 qu. Jan. 1
Amer. Aggr. 6's, w.w.[19]	4- 1-32	30	40	
Amer. Aggr. 6's, ex.w.[19]	4- 1-32	28	38	
Amer. L. & S. 1st 7's[27]	4- 6-32	70	80	
American Silica Corp. 6½'s[39]	4- 6-32	No market		
Arundel Corp. new com.	4- 1-32	23 actual sale		75c qu. Apr. 1
Bessemer L. & C. Class A	4- 5-32	.....	5	
Bessemer L. & C. 1st 6½'s[4]	4- 2-32	25	50	
Bloomington Limestone 6's[27]	4- 6-32	.....	25	
Boston S. & G. new com.[37]	4- 1-32	4	6	15c qu. Apr. 1
Boston S. & G. new 7% pfd.[37]	4- 1-32	25	35	87½c qu. Apr. 1
California Art Tile, A	3-30-32	1½	5¼	
California Art Tile, B[40]	3-31-32	.....	3	
Calaveras Cement com.	3-30-32	½	2	
Calaveras Cement 7% pfd.	3-30-32	50	56	1.75 qu. Apr. 15
Canada Cement com.	4- 5-32	47⅞	55⅝	
Canada Cement pfd.	4- 5-32	60	61	1.62½ qu. Mar. 31
Canada Cement 5½'s[42]	3-31-32	90	92	
Canada Crushed Stone bonds[42]	3-31-32	60	70	
Canada Crushed Stone com.[42]	3-31-32	5	.....	
Certainteed Products com.	4- 5-32	2	2⅛	
Certainteed Products pfd.	4- 5-32	9¾	13	1.75 qu. Jan. 1
Cleveland Quarries	4- 5-32	.....	54	25c qu. Mar. 1
Consol. Cement 1st 6½'s, A[44]	4- 6-32	No market		
Consol. Cement notes, 1941[27]	4- 6-32	No market		
Consol. Cement pfd.[27]	4- 6-32	.....	50	
Consolidated Oka Sand and Gravel (Canada) 6½'s[12]	4- 1-32	80	85	
Consolidated Oka Sand and Gravel (Canada) pfd.[41]	3-29-32	38	.....	1.75 qu. Oct.10,'31
Consol. Rock Prod. com.[9]	3-31-32	25c	35c	
Consol. Rock Prod. pfd.[9]	3-31-32	2	2½	
Consol. Rock Prod. units[35]	3-30-32	1½	2	
Consol. S. & G. pfd. (Can.)	4- 5-32	35	50	1.75 qu. Feb. 15
Construction Mat. com.	4- 5-32	⅞	2½	
Construction Mat. pfd.	4- 5-32	2½	5¾	
Consumers Rock and Gravel, 1st Mtg. 6's. 1948[35]	3-30-32	39	42	
Coosa P. C. 1st 6's[23]	4- 1-32	.....	30	
Coplay Cem. Mfg. 1st 6's[33]	4- 1-32	50	70	
Coplay Cem. Mfg. com.[33]	4- 1-32	5	7½	
Coplay Cem. Mfg. pfd.[33]	4- 1-32	25	40	
Dewey P. C. com.[47]	4- 6-32	90	100	
Dolese and Shepard	4- 5-32	15	17	$1 qu. Jan. 1
Dufferin Pav. & Cr. Stone pfd.	4- 5-32	.....	50	1.75 qu. Apr. 1
Dufferin Pav. & Cr. Stone com.	4- 5-32	2	5	
Edison P. C. com.[32]	3-18-32	1½	.....	
Edison P. C. pfd.[32]	3-18-32	5	.....	
Federal P. C. 6½'s, 1941[19]	4- 1-32	74	80	
Giant P. C. com.[2]	4- 4-32	2	4	
Giant P. C. pfd.[2]	4- 4-32	7	10	1.75 s.-a. Dec. 15
Gyp. Lime & Alabastine, Ltd.	4- 5-32	3½	3¾	10c qu. Oct.5,'31
Gyp. Lime & Alabastine 5½'s[43]	3-31-32	58	61	
Hermitage Cement com.[11]	4- 2-32	5	8	
Hermitage Cement pfd.[11]	4- 2-32	30	35	
Ideal Cement 5's, 1943[29]	4- 2-32	90	95	
Ideal Cement com.	4- 5-32	18	20	50c qu. Apr. 1
Indiana Limestone units[27]	4- 6-32	No market		
Indiana Limestone 6's	4- 5-32	11 actual sale		
International Cem. com.	4- 5-32	9	9⅜	50c qu. Mar. 31
International Cem. bonds, 5's	4- 5-32	56½ actual sale		Semi-ann. int.
Iron City Sand & Gravel 6's[36]	3-18-32	.....	70	
Kelley Is. L. & T. new stock	4- 5-32	12	15	25c qu. Apr. 1
Ky. Cons. Stone com.	4- 5-32	.....	2	
Ky. Cons. Stone pfd.	4- 5-32	.....	50	1.75 qu.
Ky. Cons. St. 1st Mtg. 6½'s[45]	4- 1-32	30	40	
Ky. Cons. St. V. T. C.[45]	4- 1-32	½	1	
Ky. Rock Asphalt com.	4- 5-32	1¾	2½	
Ky. Rock Asphalt pfd.	4- 5-32	20	25	1.75 qu. Dec.1,'31
Ky. Rock Asphalt 6½'s	4- 5-32	81½	85	
Lawrence P. C.[2]	4- 4-32	9	13	
Lawrence P. C. 5½'s, 1942[2]	4- 4-32	35	40	
Lehigh P. C. com.	4- 5-32	3½	4¼	
Lehigh P. C. pfd.	4- 5-32	62¼	63¾	1.75 qu. Apr. 1
Louisville Cement[7]	3-31-32	125	150	
Lyman-Richey 1st 6's, 1932[13]	4- 1-32	95	.....	
Lyman-Richey 1st 6's, 1935[13]	4- 1-32	90	.....	
Marblehead Lime 6's[14]	4- 1-32	No market		
Marbelite Corp. com.[35] (cement products)	3-30-32	5c	50c	
Marbelite Corp. pfd.[35]	3-30-32	50c	.....	
Marquette Cem. Mfg. 1st 5's, 1936[46]	4- 7-32	85	.....	
Marquette Cem. Mfg. 1st 6's, 1936[46]	4- 7-32	90	.....	
Material Service Corp.	4- 5-32	11½	13	
McCrady-Rodgers 7% pfd.[22]	3-31-32	40	45	87½c qu. Dec. 30, 1931
McCrady-Rodgers com.[22]	3-31-32	5	10	75c qu. Jan. 26
Medusa P. C. pfd.[47]	4- 6-32	50	60	1.50 qu. Apr. 1
Medusa P. C. com.	4- 5-32	6⅝	11½	
Monarch Cement com.[47]	4- 6-32	65	70	
Michigan L. & C. com.[6]	4- 2-32	45	.....	
Missouri P. C.	4- 5-32	7½	8½	25c qu. Jan. 30
Monolith Portland Midwest com.[9]	3-31-32	¾	1	
Monolith P. C. com.	3-31-32	1⅛	.....	40c s.-a. Jan. 1
Monolith P. C. pfd.	3-31-32	2⅞	actual sale	40c s.-a. Jan. 1
Monolith P. C. units[9]	3-31-32	8½	10	
Monolith P. C. 1st Mtg. 6's[9]	3-31-32	65	70	
National Cem. (Can.) 1st 7's[27]	4- 6-32	85	95	
National Gypsum A com.[27]	4- 6-32	1	2	
National Gypsum pfd.[27]	4- 6-32	30	33	1.75 qu. Apr. 1
National Gypsum 6's[3]	4- 6-32	50	60	
Newaygo P. C. 1st 6½'s[27]	4- 6-32	78	.....	
New England Lime 6's, 1935[14]	4- 1-32	.....	10	
N. Y. Trap Rock 1st 6's	4- 1-32	65 actual sale		
N. Y. Trap Rock 7% pfd.[30]	3- 4-32	52	.....	1.75 qu. Apr. 1
North Amer. Cem. 1st 6½'s	4- 5-32	19 actual sale		
North Amer. Cem. com.[27]	4- 6-32	½	1	
North Amer. Cem. 7% pfd.[27]	4- 6-32	1	4	
North Shore Mat. 1st 5's[15]	4- 6-32	No market		
Northwestern States P. C.[47]	4- 6-32	28	32	
Ohio River S. & G. com.	4- 5-32	.....	8	
Ohio River S. & G. 7% pfd.	4- 5-32	.....	98	
Ohio River S. & G. 6's[16]	4- 1-32	40	50	
Oregon P. C. com.[9]	3-31-32	8	12	
Oregon P. C. pfd.[9]	3-31-32	80	85	
Pacific Coast Aggr. com.[40]	3-31-32	.....	½	
Pacific Coast Aggr. pfd.[40]	3-31-32	.....	1	
Pacific Coast Aggr. 6½'s, 1944[5]	3-31-32	22	25	
Pacific Coast Aggr. 7's, 1939[9]	3-31-32	4	8	
Pacific Coast Cement 6's[5]	3-31-32	80	.....	
Pacific P. C. com.	3-30-32	3	6	
Pacific P. C. pfd.	3-30-32	.....	49	1.62½ qu. Apr. 5
Pacific P. C. 6's[5]	3-31-32	92	.....	
Peerless Cement com.[1]	4- 1-32	1/16	⅜	
Peerless Cement pfd.[1]	4- 1-32	3½	5½	
Penn.-Dixie Cement com.	4- 5-32	¾	⅞	
Penn.-Dixie Cement pfd.	4- 5-32	5¼	7	
Penn.-Dixie Cement 6's	4- 5-32	41½	actual sale	
Penn. Glass Sand Corp. pfd.[19]	4- 1-32	60	70	1.75 qu. Apr. 1
Penn. Glass Sand Corp. 6's[19]	4- 1-32	85	90	
Petoskey P. C.	4- 5-32	2½	3	
Port Stockton Cem. com.[9]	3-31-32	No market		
Riverside Cement com.[9]	3-31-32	.....	12	
Riverside Cement pfd.[9]	3-31-32	55	60	1.50 qu. Feb. 1
Riverside Cement, A	3-30-32	.....	8	
Riverside Cement, B[9]	3-31-32	70c	1	
Roquemore Gravel 6½'s[17]	4- 1-32	85	95	
Sandusky Cement 6½'s, 1932-37[19]	4- 1-32	90	100	
Santa Cruz P. C. com.	3-30-32	.....	70	$1 qu. Apr. 1
Schumacher Wallboard com.	3-30-32	1½	.....	
Schumacher Wallboard pfd.	3-30-32	.....	23½	50c qu. Feb. 15
Southwestern P. C. units[35]	3-30-32	150	.....	
Standard Paving & Mat. (Canada) com.	4- 5-32	1½	2½	
Standard Paving & Mat. pfd.	4- 5-32	.....	35	1.75 qu. Feb. 5
Superior P. C., A	3-30-32	27	28	27½c mo. May 1
Superior P. C., B	3-30-32	6¼	.....	12½c Mar. 21
Trinity P. C., units[47]	4- 6-32	35	40	
Trinity P. C. com.[47]	4- 6-32	5	10	
Trinity P. C. pfd.[47]	4- 6-32	30	35	
U. S. Gypsum com.	4- 5-32	16¼	17	40c qu. Mar. 31
U. S. Gypsum pfd.	4- 5-32	103¼	106	1.75 qu. Mar. 31
Wabash P. C.[21]	4- 1-32	8	11	
Warner Co. com.[16]	4- 1-32	4½	5½	25c qu. Oct.15,'31
Warner Co. 1st 7% pfd.[16]	4- 1-32	.....	70	1.75 qu. Apr. 1
Warner Co. 6's 1944 no war.	4- 1-32	65	.....	
Warner Co. 6's, 1944, with war.	4- 1-32	65	70	
Whitehall Cem. Mfg. com.[10]	4- 1-32	40	41	
Whitehall Cem. Mfg. pfd.[10]	4- 1-32	41	43	
Wisconsin L. & C. 1st 6's[15]	4- 6-32	40	.....	
Wolverine P. C. com.	4- 5-32	1	3¼	15c qu. Nov.15,'31
Yosemite P. C. A. com.[9]	3-31-32	1	1½	

Quotations by: [1]Watling Lerchen & Hayes Co., Detroit, Mich. [2]Bristol & Willett, New York. [3]Rogers, Tracy Co., Chicago. [4]Butler, Beadling & Co., Youngstown, Ohio. [5]Smith, Camp & Riley, San Francisco, Calif. [6]Frederick H. Hatch & Co., New York. [7]J. J. B. Hilliard & Son, Louisville, Ky. [8]Dillon, Read & Co., Chicago, Ill. [9]A. E. White Co., San Francisco, Calif. [10]Lee Higginson & Co., Boston and Chicago. [11]J. W. Jakes & Co., Nashville, Tenn. [12]James Richardson & Sons, Ltd., Winnipeg, Man. [13]Stern Bros. & Co., Kansas City, Mo. [14]First Wisconsin Co., Milwaukee, Wis. [15]Central-Republic Bank & Trust Co., Chicago. [16]J. S. Wilson, Jr., Baltimore, Md. [17]Citizens Southern Co., Savannah, Ga. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hewitt, Ladin & Co., New York. [20]Tucker, Hunter, Dulin & Co., San Francisco, Calif. [21]Baker, Simonds & Co., Inc., Detroit, Mich. [22]Peoples-Pittsburgh Trust Co., Pittsburgh, Penn. [23]Howard R. Taylor & Co., Baltimore. [24]Richards & Co., Philadelphia, Penn. [25]Hincks Bros. & Co., Bridgeport, Conn. [26]Bank of Republic, Chicago, Ill. [27]National City Co., Chicago, Ill. [28]Chicago Trust Co., Chicago, Ill. [29]Boettcher-Newton & Co., Denver. [30]Hanson and Hanson, New York. [31]S. F. Holzinger & Co., Milwaukee, Wis. [32]Tobey and Kirk, New York. [33]Steiner, Rouse and Co., New York. [34]Jones, Heward & Co., Montreal, Que. [35]Tenney, Williams & Co., Los Angeles, Calif. [36]Stein Bros. & Boyce, Baltimore, Md. [37]Wise, Hobbs & Arnold, Boston. [38]E. W. Hays & Co., Louisville, Ky. [39]Blythe Witter & Co., Chicago, Ill. [40]Martin Judge Co., San Francisco, Calif. [41]A. J. Pattison Jr. & Co. Ltd., Toronto, Canada. [42]Nesbitt, Thomson & Co., Toronto. [44]E. H. Rollins, Chicago. [45]Dunlap, Wakefield & Co., Louisville, Ky. [46]First Union Trust & Savings Bank, Chicago. [47]Anderson Plotz and Co., Chicago, Ill.

Alpha Portland Cement Co.'s Annual Report

THE ANNUAL REPORT of the Alpha Portland Cement Co. for the year ended December 31, 1931, contains the following:

The loss shown for 1931 was due, first, to a reduction in the consumption of the product throughout the territory where the company operates, and, second, the ruinously low prices generally current in all sections, but especially in the Middle Western territory. These low prices were brought about by the very large surplus capacity for cement production in the United States, which engendered excessively keen competition. The United States Government figures show only 47% of the available plant capacity used for shipments in 1931. The F. W. Dodge Reports indicate a reduction of 32% in volume of construction in 1931 when compared with 1930, and a reduction of 53% when compared with the peak year of 1928. Shipments of cement in the United States totaled 127,000,000 bbl. in 1931—22,000,000 less than were shipped in 1930, and 48,000,000 less than in 1928.

Because of this situation it seemed wise to the board of directors to reduce the common stock dividend. Drastic economies were instituted in all branches of the company's affairs, including a reduction on June 1, 1931, of wages and salaries, ranging from 10% to 16 2/3%. Inventories which were greatly reduced in quantity in 1930 were still further reduced and adjustments bringing their value to cost or market, whichever was lower, were made where necessary at the close of the year.

The cash position of the company is excellent and the relation of current assets to liabilities the best in its history. There was credited to surplus during the year $12,158.03, the unused portion of reserve set up for federal income and excess profits taxes not required for this purpose, and $5,648,500 due to a reduction in the stated value of the common stock of the company, as approved by more than two-thirds of each class of the outstanding stock of the company at a special meeting of the stockholders held September 30, 1931.

There has been a reduction in the market value of securities held by the company, due to the generally depressed market, but on account of the high character of these investments it is expected this loss will largely, if not entirely, be eliminated when market values more nearly approach real values. In the meantime the directors decided to carry these securities at market as of December 31, 1931. This necessitated a charge to surplus of $426,337.83.

During the year 21,500 shares of the common stock of the company were pur-

CONDENSED SUMMARY OF INCOME AND SURPLUS OF THE ALPHA PORTLAND CEMENT CO.

(For the Years Ended December 31, 1931 and 1930)

	Year ended December 31, 1931	1930
Net sales	$ 6,012,602.27	$ 9,936,820.79
*Operating expenses	7,015,543.48	8,704,310.35
Loss (profit) from operations	$ 1,002,941.21	$ 1,232,510.44
Miscellaneous income—net	223,990.04	185,842.60
Net loss (income) for the year, before provision for federal income tax	$ 778,951.17	$ 1,418,353.04
Provision for federal income tax (estimated)	.....	170,000.00
Net loss (income) for the year—from ordinary operations	$ 778,951.17	$ 1,248,353.04
Surplus at beginning of the year	3,896,066.12	4,715,486.89
Surplus credits:		
Reduction of stated value of common capital stock	5,648,500.00	.....
Unused portion of provision for additional federal income taxes—prior years	12,158,03	.....
Gross surplus	$ 8,777,772.98	$ 5,963,839.93
Surplus charges:		
Dividends:		
On preferred capital stock	$ 140,000.00	$ 140,000.00
On common capital stock	711,000.00	1,599,750.00
Write-down of United States Government and municipal securities to market values as of December 31, 1931	426,337.83	.....
Additional depreciation for the year 1928 as adjusted by the Treasury Department	.....	32,365.94
Provision for additional federal income taxes—prior years	.....	200,000.00
Adjustment of sack inventory to market value at December 31, 1930	.....	95,657.87
Total	$ 1,277,337.83	$ 2,067,773.81
Surplus at end of the year	$ 7,500,435.15	$ 3,896,066.12
*Including:		
Depreciation and depletion	$ 1,410,589.44	$ 1,390,311.69
Maintenance and repairs	603,144.90	890,376.65

CONDENSED CONSOLIDATED BALANCE SHEET OF THE ALPHA PORTLAND CEMENT CO.

(December 31, 1931 and 1930)

ASSETS	1931—December 31—1930	
Current assets:		
Cash	$ 3,478,715.09	$ 5,372,271.96
Certificates of deposit	20,000.00	125,000.00
United States Liberty Loan bonds, treasury bonds, New York City corporate stock, municipal tax warrants, etc. (1931, at market values as of December 31, 1931; 1930, at cost)	2,528,612.61	1,861,200.44
Working funds, advances, etc.	146,416.22	131,897.68
Accounts and notes receivable, less reserves for discounts, freight and doubtful accounts	639,667.01	377,791.48
Inventories—Finished cement, clinker, sacks, materials and supplies (based on physical inventories and lower of cost or market)	1,723,839.57	2,273,704.84
Total currents assets	$ 8,537,250.50	$10,141,866.40
Common capital stock of Alpha Portland Cement Co., 21,500 shares—at cost	$ 228,965.00	.....
Investment in and advances to subsidiary company, and miscellaneous investments—at cost	$ 296,766.58	$ 289,823.78
Property:		
Land, buildings, machinery and equipment	$33,585,585.01	$33,642,490.56
Less reserves for depreciation, depletion, etc.	13,797,627.47	12,548,264.56
Net property	$19,787,957.54	$21,094,226.00
Deferred items	$ 159,569.22	$ 158,296.01
Total	$29,010,508.84	$31,684,212.19

CONDENSED CONSOLIDATED BALANCE SHEET OF THE ALPHA PORTLAND CEMENT CO.

(December 31, 1931 and 1930)

LIABILITIES	1931—December 31—1930	
Current liabilities:		
Accounts payable	$ 162,195.10	$ 163,225.43
Wages payable	8,924.85	17,159.32
Accrued taxes—current year (estimated)	43,194.76	210,479.15
Dividend payable	177,750.00	355,500.00
Total current liabilities	$ 392,064.71	$ 746,363.90
Reserves:		
Compensation and other insurance	$ 601,308.17	$ 601,287.77
Miscellaneous	30,700.81	305,994.40
Total reserves	$ 632,008.98	$ 907,282.17
Capital stock:		
Preferred 7% cumulative (authorized and outstanding, 20,000 shares of $100 each)	$ 2,000,000.00	$ 2,000,000.00
Common—Without par value (authorized, 1,000,000 shares; issued and outstanding, 711,000 shares)	18,486,000.00	24,134,500.00
Total capital stock	$20,486,000.00	$26,134,500.00
Surplus	$ 7,500,435.15*	$ 3,896,066.12
Total	$29,010,508.84	$31,684,212.19

*Including $5,648,500 arising from reduction of stated value of common capital stock in 1931.

chased in the open market. These appear on the balance sheet at cost.

The rate of plant operation was the lowest in 1931 of the last twenty-five years. However, through reduction of the daily plant production and with complete cooperation on the part of plant management, it was possible to increase the number of months each plant operated; also by reducing the number of hours worked by each man daily, work was distributed among the greatest number of men possible—all without decreasing efficiency. This materially helped the unemployment situation where the company's plants are located.

The properties have been maintained in good physical condition, and included in operating expense for the year is a charge of $1,410,589.44 for depreciation and depletion, an amount slightly higher than the previous year. The Bellevue and Martins Creek No. 3 plants were not operated in 1931. There has been a reduction during the past two years in the item of maintenance cost due entirely to decreased production. The per barrel cost of maintenance and repairs is practically the same from year to year. In a report made at the end of the year by the company's engineers after a complete survey of the properties, the statement was made, "the plants are in better condition than ever before."

Large capital expenditures for new construction were not considered necessary or advisable by the board of directors in view of existing conditions and further, a sum in excess of $14,000,000 had been spent on the plants and properties of the company in the past eight years. There was, however, authorized and completed during the year a new coal mill at Jamesville, N. Y.; new superheaters for waste-heat boiler system at Martins Creek No. 4, Pennsylvania; new quarry cars and electrical equipment for power factor correction at La Salle, Ill.; and special equipment for loading bulk cement at Catskill, N. Y.

For the second year in succession the company had no fatalities in its organization, and the Ironton, Ohio, plant completed on December 9, 1931, its fifth year without a lost-time accident.

Manufacturing costs continued to be reduced in 1931, the results being materially lower than any record made since the war, and, if adjusted to pre-war prices, far lower than any costs ever made by the company.

Recent Dividends Announced

Boston Sand & Gravel com. (qu.)	$0.15	Apr. 1
Boston Sand & Gravel pfd. (qu.)	0.87½,	Apr. 1
Kelley Island L. & T. (qu.)	0.25,	Apr. 1
Liberty Limestone pfd. (qu.)	1.75,	Apr. 1
Medusa P. C. pfd. (qu.)	1.50,	Apr. 1
Newaygo P. C. pfd. (qu.)	1.75,	Apr. 1
Pacific P. C. pfd. (qu.)	1.62½,	Apr. 5
Southwestern P. C. pfd. (qu.)	2.00,	Apr. 15
Superior P. C. Cl. A (mo.)	0.27½,	May 1
Wallace Sandstone Quarries, Ltd., pfd.	1½%,	Apr. 15

Boston Sand and Gravel Co. Annual Report

THE Boston Sand and Gravel Co., Boston, Mass., reports for the years ending December 31 as follows:

CONSOLIDATED INCOME ACCOUNT, YEARS ENDED DECEMBER 31

	1931	1930
Gross earnings	$1,292,790	$1,466,822
Operating expenses and taxes	1,044,432	1,146,554
Depreciation	98,817	106,334
Depletion	16,148	20,462
Operating income	133,393	193,472
Interest	30,234	33,319
Net income	103,159	160,153
Preferred dividends	61,746	59,359
Common dividends	37,290	80,000
Surplus	$4,123	$20,794
Earned per share, common	$0.84	$2.02
Number of common shares	49,180	50,000

CONSOLIDATED BALANCE SHEET, AS OF DECEMBER 31

Assets:	1931	1930
*Plant and equipment	$2,226,607	$2,270,336
Current assets:		
Cash and securities	205,358	344,689
Inventories	1,362	2,427
Notes and accounts receivable	177,631	187,789
Other investments	113,968	.....
Deferred charges	48,473	25,349
Total	$2,773,399	$2,830,590
Liabilities:		
Preferred stock	$880,200	$871,950
†Common stock and surplus	1,337,761	1,368,551
Bonded debt	419,500	443,500
Purchase money mortgage	70,150	70,150
Current liabilities:		
Accounts payable and accruals	65,788	76,439
Total	$2,773,399	$2,830,590
Current assets	$384,351	$534,905
Current liabilities	65,788	76,439
Working capital	$318,563	$458,466

*After depreciation and depletion. †Represented by no par shares: 1931, 49,180; 1930, 50,000.

Monolith Portland Cement

THE Monolith Portland Cement Co., Los Angeles, Calif., for the year ended December 31, 1931, shows a net loss of $4799, after extraordinary flood expenses of $22,585 at Monolith. This compares with net profit of $21,244, after charges and taxes, for the previous year.

The Monolith Portland Midwest Co., a subsidiary, for the year ended December 31, last, reports net loss of $87,298, compared with a net loss of $113,952 for the previous year, and a net loss of $217,204 for 1929.

The income account of Monolith Portland Cement Co., for the year ended December 31, 1931, compares as follows:

	1931	1930	1929
Net sales	$1,452,046	$1,720,692	$2,421,168
Costs and expenses	1,154,108	1,404,800	†2,157,567
Depreciation	208,172	198,031	.....
Operating income	$89,766	$117,861	$263,601
Income receivable and other income	.....	.....	46,160
Total income	$89,766	$117,861	$309,761
Interest, amortization of bond discount and expense	71,980	82,617	64,571
Other reserves	.....	9,000	.....
Federal taxes	.....	5,000	26,000
Extraordinary flood expense at Monolith	22,585	.....	.....
Net loss	$4,799	*$21,244	*$219,190

* Net profit. †Includes depreciation.

The consolidated balance sheet as of December 31, 1931, shows current assets of $726,413, against current liabilities of $201,946, or a ratio of 3.5 to 1.

This balance sheet is the first consolidated statement of condition that the company has issued, consequently comparisons are not available. The consolidated statement as of December 31, follows:

Assets: Cash, accounts and notes receivable, $297,899; inventories, $428,513; total current assets, $726,413; other assets and investments, $52,489; plant and equipment, less reserves for depreciation, $4,526,954; leasehold limestone deposits, $7,593,403; prepaid and preferred items, $670,392; good will and patent rights, $1; total assets, $13,569,651.

Liabilities: Current liabilities, $201,946; first mortgage 6% bonds, $922,000; trust deed notes of 1933, $7,500; Monolith Portland Midwest Co. preferred stock ($10 par), $2,974,000; Monolith Portland Cement Co. preferred ($10 par), $1,479,000; Monolith Portland common stock stated value (no par), $2,241,240; capital and surplus, less deficit of Monolith Portland Midwest Co., $5,743,965; total, $13,569,651.

Dolese and Shepard Co.

THE Dolese and Shepard Co., Chicago, Ill., producer of crushed stone, reports for the year ended December 31, 1931:

	1931	1930
Net income after charges	$ 8,303	$ 76,604
Dividends	95,740	153,184
Deficit	$ 87,437	$ 76,580
Earned per share	$0.43	$4.00

Number of shares, 19,148.

BALANCE SHEET AS OF DECEMBER 31

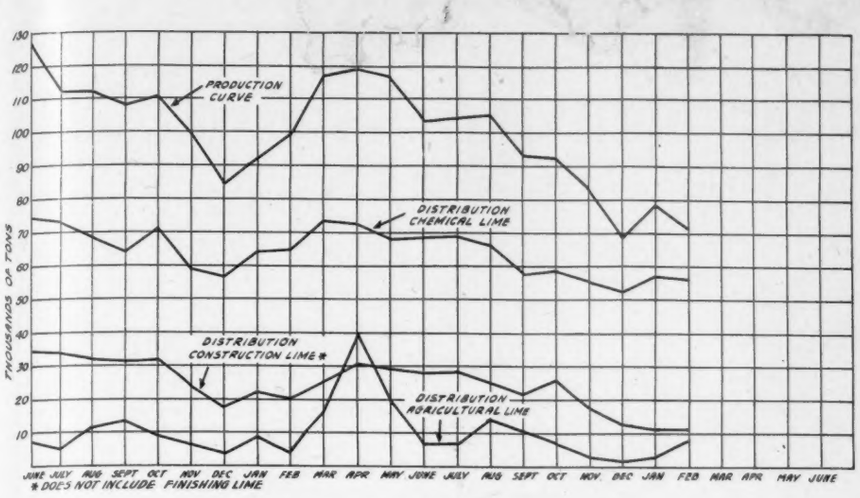
Assets:	1931	1930
*Plant and equipment	$ 435,907	$ 479,909
Real estate (net)	606,591	572,616
Current assets:		
Cash	21,865	53,134
Marketable securities (cost)	216,253	216,253
Accounts receivable	46,930	43,346
Notes receivable	1,523	2,360
Mortgage notes receivable	8,400	16,785
Accrued interest	3,528	4,102
Inventories	92,897	95,238
Prepayments	4,758	2,334
Total	$1,438,652	$1,486,078
Liabilities:		
Capital stock	$ 957,400	$ 957,400
Current liabilities:		
Accounts payable	9,245	7,548
Dividends payable	19,148	38,296
Notes payable	17,500	.....
Local tax reserve	53,036	54,000
Federal tax reserve	6,645	11,898
Surplus	375,678	416,939
Total	$1,438,652	$1,486,078
Current assets	$ 391,396	$ 431,218
Current liabilities	105,574	111,739
Working capital	$ 285,822	$ 319,479

*Less depreciation: 1931, $649,766; 1930, $603,168.

The outlook for 1932 is stated to be encouraging.

Conversion Factors

A COMPENDIUM of useful data for the rapid conversion of the common engineering units of measure of one system into the different but related units of another system has been prepared by the Dorr Co., Inc., New York, N. Y. This compendium is available to those interested.


PRODUCTION CURVE
DISTRIBUTION CHEMICAL LIME
DISTRIBUTION CONSTRUCTION LIME*
DISTRIBUTION AGRICULTURAL LIME
THOUSANDS OF TONS
JUNE JULY AUG SEPT OCT NOV DEC JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DEC JAN FEB MAR APR MAY JUNE
* DOES NOT INCLUDE FINISHING LIME

Operations of lime industry for 20 months

Production and Distribution of Lime

THE ACCOMPANYING CHART shows statistics of operations in the lime industry for a 20-month period ending with February, 1932.

This information, supplied by the National Lime Association, represents 50% of the total lime production of the country. Reasonable accuracy in estimating total production should be obtained from it by doubling the amounts shown in the chart.

Dismiss Dust Suit Against U. S. Gypsum

THE DUST CASE against the New Brighton plant of the United States Gypsum Co. was dismissed on March 30 and the company was exonerated of a charge of creating a nuisance by spreading gypsum dust over the New Brighton area.

The court agreed that witnesses for the prosecution had established the presence of the artificial "snow" on sidewalks, lawns, trees and buildings in the vicinity of the New Brighton factory.

But, the court maintained, the prosecution had failed to prove that the dust had originated in the U. S. Gypsum Co. plant.

"The conditions testified to are not sufficient to constitute a public nuisance," the Chief Justice declared.

A large portion of the gallery was said to be made up of New Brighton residents who were ready and anxious to testify that the U. S. Gypsum Co. is not a nuisance.—*Staten Island* (N. Y.) *Advance.*

British Cement Group Maintains Good Position

THROUGHOUT the prolonged period of depression, the British cement trade has maintained a favorable position. Competition has been severe, and selling prices have been lower, but improved methods of production and extensions in manufacturing capacity have effectively countered the unfavorable factors.

With the "Red Triangle" group now embodied in the "Blue Circle" group, the British cement trade has been consolidated on a basis which strengthens the position of the Associated Portland Cement Manufacturers, Ltd., the amalgamated organization. The full benefit of the acquisition of the "Red Triangle" interests has yet to be reaped.

The merged organization achieved record results in 1931. The 8% dividend paid on the ordinary capital is the same as for each of the four preceding years, and there is a large margin of cover behind the prior charge issues. The group has a share and debenture capital of £10,000,000 ($50,000,000 at par).

Progressive results have been shown for the past five years by British Portland Cement Manufacturers, Ltd., which is controlled by the combine. Dividends on the ordinary shares of this subsidiary for the past 11 years have not been less than 10%, while the rate for the last five years has been 15% per annum. Both the parent and subsidiary concerns carry large cash and investment resources.

Including the huge "Red Triangle" output, the combine is now responsible for approximately 70% of Britain's domestic cement deliveries.

Refuse Clay from Refining for Cement

A RECENT DISCOVERY made by J. M. Evans of the Associated Oil Co.'s research department is announced. It has recently been adopted by one of the large Pacific coast cement companies in the manufacture of cement. The new discovery utilizes the spent clay used in refining.

In the manufacture of petroleum products such as gasoline, kerosene and lubricating oils it has been the practice for many years to decolorize these products and purify them by a process known as contact filtration. In this process a chemically reactive clay is ground to the fineness of flour and mixed with the oil at elevated temperatures. The clay is then filtered out of the oil and carries with it the resinous bodies which have caused the dark color. This clay, after use, was a waste product at the refinery and was difficult to dispose of.

It is claimed that Mr. Evans' discovery has shown that a small percentage of this clay, in the neighborhood of 3 to 5% will improve portland cement. The spent clay is ground into the cement at the time of manufacture and is said to produce a portland cement having greater plasticity as well as water-proof properties and increased strength.

Builds Demonstration Road

ONE of the most interesting new features of the British Industries Fair this year was the quarry, roads, and mining section at the heavy industries branch of the Fair in Birmingham. This was the first time the quarry industry has been represented. Quarry operators and concerns engaged in road work have been affected adversely by the national economy campaign now under way. They did, however, come to the Fair to show what they can do and to justify their claim to build unexcelled roads.

To demonstrate what they could do they constructed a new road alongside the exposition building. This road was constructed during the two weeks' run of the Fair and was inspected by a very large crowd of interested persons.

Deny Rate Increase on Agricultural Limestone

THE Tennessee state railroad and public utilities commission has upheld the protest of the American Limestone Co., Knoxville, and Franklin Limestone Co., Nashville, against the increase in freight rates on ground or pulverized limestone or marble.

The L. & N., N. C. and St. L., Southern and Tennessee Central roads proposed the increase on these products to be effective October 20, 1931, but were forestalled by the suspension of the rates by the commission.

As the result of the hearing before the commission on February 11, the commission held the proposed increase has been found to be "unjust, unreasonable and unduly discriminatory" and should not be put into effect.

Instead the commission ruled the rates on these products should not exceed rates on crushed stone and stated that after 30 days all railroads were notified that rates on carload lots, with a minimum of 60,000 lb., should not exceed the rates on crushed stone.—*Knoxville* (Tenn.) *Journal.*

Traffic and Transportation

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week ending April 2:

TRUNK LINE ASSOCIATION DOCKET

28876. **Crushed stone, sand and gravel,** carloads (See Note 2), from Otisville, N. Y., to Orange Farms, N. Y., *50c per net ton, plus emergency charge. (See Note 4.)

*To expire November 1, 1932.

28887. **Stone, crushed or broken, coated or not coated with tar, oil or asphaltum,** carloads (See Note 2), from Oriskany Falls and Munns, N. Y., to D. L. & W. R. R., Syracuse Division.

To	Prop. rate	To	Prop. rate
Itaska	$1.20	McGraw	1.35
Whitney Point	1.20	Solon	1.40
Lisle	1.20	East Freetown	1.50
Killawog	1.20	Gee Brook	1.60
Marathon	1.20	Cincinnatus	1.60
Messengerville	1.30	Homer	1.30
Blodgett Mills	1.30	Little York	1.40
Cortland	1.30		

Rates in cents per net ton. (See Note 5.)

28897. **Common sand,** carloads (See Note 2), from Philadelphia, Penn., to Pottsville, Penn., $1.25 per net ton. (Present rate, $1.40.) Reason—Proposed rate is comparable with rates to Auburn and Harrisburg, Penn.

28903. (1) **Stone, crushed or broken, and stone screenings;** (2) **gravel and sand** (other than blast, engine, fire, glass, molding or foundry, quartz, silex and silica), carloads (See Note 2), from Cumberland, Md. (See Note 4).

To	Proposed rates *	†
Oldtown, Md.	(1) 50	70
Town Creek, Md.	(2) 64	70

*To expire March 31, 1933.
†Effective April 1, 1933.

CENTRAL FREIGHT ASSOCIATION DOCKET

30902. To correct Item 145, page 26 of C. F. A. L. Tariff I. C. C. No. 2512, applying on **sand,** carload, minimum weight 40,000 lb., to Kansas City, by eliminating origin stations Conneaut, O., Girard, Wallace Jct. and West Springfield, Penn., for account of Bessemer and Lake Erie railroad.

30913. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) and **gravel,** carloads, from Indianapolis, Ind., to Waveland and Brown's Valley, Ind., rate of 180c per net ton, rate to expire six months after effective date. Present: *95c per P. R. R. Tariff 118-B.

*Plus 6c emergency charge.

30934. To establish on **agricultural limestone,** in box cars, carload, minimum weight 50,000 lb., from Gibsonburg and Woodville, O., to Chicago, Ill., rate of 230c per net ton. Present, 280c.

30941. To establish on **crushed stone,** carload, in open top cars, from Lorain, O. (ex-lake), to Barberton, O., rate of 70c per net ton. Present, 80c.

30970. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica), carloads, in open top cars only, from Cleveland, O., to New Castle, 100c; West Newton, 140c; Uniontown, Penn., 160c per net ton. Present—115c to New Castle; 220c to West Newton and Uniontown, Penn.

30971. To establish on **crushed stone or crushed stone screenings,** in open top cars, carloads, from Bellevue, O., to Homer and Medina, O., rate of 75c per net ton. Present—80c.

30981. To establish on **stone, crushed, coated with oil, tar or asphaltum,** carloads, from Kenton, O., to points in Michigan, rates as shown in Exhibit A attached. Present—Official Classification basis.

EXHIBIT "A"
(Rates in cents per net ton)

To—	Prop. rate
Fennville, Route 1*	257
Flint, Routes, 1, 2, 27*†	199
Grand Haven, Routes, 1, 2, 27*†	257
Grand Ledge, Route 1*	211
Grand Rapids, M. C., N. Y. C. delivery, Routes 1, 2, 27, 31*†	234
Howard City, P. R. R. delivery, Routes 1, 53, 55, 607, 619*	234
Howell Route 1*	188
Ionia, Routes 1, 2, 27*†	222
Lansing, N. Y. C. delivery, Routes 1, 2, 27*†	199
Mason, M. C. delivery, Route 31	211
Midland, M. C. delivery, Routes, 1, 31*	222
Muskegon, Routes 1, 2, 27, 32, 53, 55, 619†	257
Plainwell, P. R. R., N. Y. C. delivery, Routes 1, 53, 55, 619	211
Pontiac, Routes, 6, 27†	199
St. Johns, Routes, 2, 27†	199
Saginaw M. C., Routes 1, 31*	211
Shelbyville, P. R. R. delivery, Routes 53, 55, 619	211
Three Oaks, M. C. delivery, Route 31	280
Vineland, M. C. delivery, Route 31	280
Watervliet, Route 1*	280
White Cloud, Route 1*	268

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

Note 4—Reason—To meet motor truck competition.

Note 5—Reason—Proposed rates are comparable with rates on like commodities for like distances, services and conditions.

Explanation of Routes

Grand Trunk

2—N. Y. C. R. R., Toledo, O., A. A. R. R., Durand, Mich., Grand Trunk.
6—N. Y. C. R. R., Toledo, O., A. A. R. R., Lakeland, Mich., Grand Trunk.
27—N. Y. C. R. R., Toledo, O., D. & T. S. L. R. R., Detroit, Mich., Grand Trunk.
32—N. Y. C. R. R., Toledo, O., A. A. R. R., Ashley, Mich., Grand Trunk, M. C. R. R.
31—N. Y. C. R. R., Toledo, O., M. C. R. R. N. Y. C. R. R.
1—N. Y. C. R. R. direct.

P. R. R.

53—N. Y. C. R. R., Kendallville, Ind., P. R. R.
55—N. Y. C. R. R., Sturgis, Mich., P. R. R.
607—N. Y. C. R. R., Toledo, O., P. M., Grand Rapids, Mich., P. R. R.
619—N. Y. C. R. R., Mortimer, O., N. K. P., Fort Wayne, Ind., P. R. R.

P. M. R. R.

1—N. Y. C. R. R., Toledo, O., P. M.

*P. M. delivery. †G. T. delivery.

30995. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry glass grinding or polishing, loam, molding or silica) and **gravel,** carloads, from Ginger Hill and Rupel, Ind., to Walkerton, Ind., rate of 50c per net ton. Present—62c.

31029. To establish on **slag** (a product of iron and steel blast or open hearth furnaces), carloads, from Hamilton, O., to N. & W. Ry. stations, viz.: Mowrystown, Taylorsville, East Danville, 104c; New Market, Shackelton, O., 122c per net ton. Present—Class rates.

31034. To establish on **sand and gravel,** carload, from Kaley Pit (South Bend), Ind., to Furnessville, Ind., rate of 76c per net ton, subject to emergency tariff. Present rate—80c.

31035. To establish on **sand and gravel,** carload, from Jackson, O., to Mineral Ridge, O., rate of 165c per net ton via D. T. & I. R. R., Maitland, O., Erie R. R. rate to expire six months from effective date. Present rate—21c (class rate).

WESTERN TRUNK LINE DOCKET

365-D. Rates: **Sand and gravel,** carloads, from Mason City, Ia., to destinations on C. & N. W. Ry. and C. M. St. P. & P. R. R. in Southwestern Minnesota. Rates: Present—Class or combination. Proposed—To add to Item 2180-C of W. T. L. Tariff 13-P the joint line mileage scales shown in Item 2200 of W. T. L. Tariff 13-P.

3350-E. Minimum weights: **Sand, stone, crushed, gravel** and other low-grade heavy-loading commodities between stations in W. T. L. and S. W. L. territories; also between points in W. T. L. and points in S. W. L. territories. Minimum weight: Present (See Note 3). Proposed (See Note 1), except when car is loaded to full cubical visible capacity actual weight will apply.

3350-E. Minimum weights: **Sand, stone, crushed, gravel,** and other low-grade heavy-loading commodities between stations in W. T. L. and S. W. L. territories; also between points in W. T. L. and points in S. W. L. territories. (See preceding announcement.)

7922. Rates, **sand,** carload (See Note 2), but not less than 40,000 lb., from Maiden Rock and Hager, Wis., to Freeport, Ill. Rates, present, $2.40 per net ton; proposed, $1.90.

2556-V. **Sand,** carload, from Hager, Wis., to points in Michigan, O., etc., as shown in Item 4360 of W. T. L. Tariff 49-R. Please refer to Docket Bulletin No. 2926 dated March 19, 1931, Docket No. 2556-V. This subject has now been cancelled from the docket.

6146-M. Minimum weights: **Sand,** carload, as described in W. T. L. Tariff 41-S, I. C. C. No. A-2243, from Millington, Ore., Ottawa, Rochelle, Sheridan, Utica and Wedron, Ill., to points of destination to which rates are published in W. T. L. Tariff 41 from the origin points shown. Minimum weight: Present—Minimum weight is determined by size of the car used (except as shown in Item 230). Proposed—When a carrier cannot furnish car of the capacity or dimensions ordered by shipper, after six full days' notice therefor has been given by the shipper, and for its own convenience furnishes car of greater capacity than the one ordered by shipper, it will be used on the basis of the minimum carload weight fixed in tariff or classification to apply on size of car ordered by shipper, but in no case less than the actual weight, provided the shipment could have been loaded upon or in a car of the size ordered.

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

24898. **Stone, broken or crushed,** in bulk, in gondola or other open cars (See Note 3), from Westfield, Mass., to White Plains, N. Y. Present, $1.10; proposed, $1.04 per net ton. (To expire December 31, 1932, unless sooner canceled, changed or extended.) Reason—Change necessary to meet existing contracts made on the $1.10 rate.

24928. **Stone, crushed** (trap rock), also **amiesite or stone, crushed, coated with oil, tar or asphalt** in bulk, in gondola or other open-top cars (See Note 3), from Westfield, Mass., to Claverack, Hudson Upper and Hudson, N. Y. Proposed—Crushed $1.10, coated $1.20; present—crushed $1.25, coated $1.35 per net ton (See Note 5).

24946. **Common sand and gravel,** minimum weight 50 net tons of 2000 lb., from Littleton and Bedford, Mass., to Boston, Cambridge, Somerville and West Cambridge, Mass., from Gleasondale (T), Maynard, South Acton, Topsfield, Wayland and West Concord, Mass., to Belmont, Boston, Cambridge, Somerville, Waltham, Waverley and West Cambridge, Mass.; from Gleasondale (T) and Lancaster, Mass., to Worcester, Mass. Present—50c. Proposed—45c per net ton. (To expire March 31, 1933, unless sooner canceled, changed or extended.) Reason—Unless the proposed rate is published, the material will be moved into Boston by barge or into Boston or Worcester by truck from local pits, thereby depriving the rail carrier of a haul.

ILLINOIS FREIGHT ASSOCIATION DOCKET

5792-B. **Crushed stone, carloads** (See Note 4), from Pontiac, Ill., to Joliet, Ill. Present—Class rate. Proposed—88c per net ton.

4965, Sub. 4. **Sand,** carloads (See Note 1), from Bowes, Ill., to Milwaukee, Wis. Rates per ton—Present, $1.40; proposed, $1.10.

4956, Sub. 5. **Molding sand,** carloads (See Note 1), from Bowes, Ill., to Plano and Sandwich, Ill. Present—Class rates. Proposed, $1.35 per net ton.

4956, Sub. 6. **Molding sand,** carloads (See Note 1), from Bowes, Ill., to Morris, Ill. Present—Class rates. Proposed, $1.30 per net ton.

6547. **Sand and gravel,** carloads (See Note 2), but not less than 40,000 lb., from Arenzville, Ill., to O'Fallon and New Athens, Ill. Rates per ton:

To—	Present	Proposed
O'Fallon, Ill.	$2.30	$1.26
New Athens, Ill.	2.30	1.40

6552. **Sand and gravel,** from Magner, Ill., to C. & I. M. Ry. stations, rates per net ton, to representative points: Havana, Ill., $1.20; Kelsey, Ill., $1.13; Barr, Ill., $1.10; Andrew, Ill., $1.01; Cimic, Ill., $1.13.

6554. **Stone, broken, crushed or ground,** chatts

(lead or zinc mine refuse), rubble stone (rough broken, irregular pieces, not machined or tooled), rip rap, **strippings, stone quarry,** carloads (See Note 3), but not less than 40,000 lb., from Hannibal, Mo., to various stations in Wisconsin. Rates per net ton to representative points in Wisconsin.

	Pres. Prop.		Pres. Prop.
Racine	* $2.14	Watertown ..	* 2.30
Milwaukee ..	* 2.14	Oconomowoc	* 2.30

*Through class or lowest combination of intermediate rates.

6562. **Sand and gravel,** carloads, minimum weight 90% of marked capacity of car, except when car is loaded to full cubical or visible capacity actual weight will apply but not less than 60,000 lb., from Joliet, Ill., to Chase and Troxel, Ill. Rates per net ton. Present, 88c; proposed, 72c.

6482. **Sand, viz., lake, river and bank,** other than sand loam (See Note 2), from Calumet, Gary, Willow Creek and Crocker, Ind., to De Kalb, Ill. Present—Combination. Proposed—$1.39 per net ton.

Proposed I. C. C. Decisions

23823. **Plasterboard.** A revision of the rates and minimum weights on plasterboard within and to points within western trunk line territory from the southwest has been recommended by Examiner C. W. Griffin in Gypsum Association et al. vs. A. T. & S. F. et al. After making his recommendations, the examiner said that any necessary modifications of the findings in Upson Co. vs. Ann Arbor, 157 I. C. C. 586, should be made. There was insufficient evidence, Examiner Griffin said, upon which to base a finding with respect to reparation. He recommended findings of unreasonableness on several phases of the case, thereby raising the question as to whether there should be reparation.

The complaint alleged that the rates and minima on plasterboard and plaster wallboard from Fort Dodge, Ia., and from producing points in Oklahoma and Texas, of which Southard, Okla., and Sweetwater, Tex., were representative, to points in western classification territory, including points in southern Illinois, southern Indiana, Wisconsin and the upper peninsula of Michigan, also the rule governing the transportation of gypsum and gypsum products in mixed carloads, were unreasonable. It further alleged, he said, that, compared with the rates on like traffic in the opposite direction from producing points in California, the rates on plasterboard and plaster wallboard, from the points of origin indicated to points in California and other destinations in transcontinental territory were unduly prejudicial to complainants' plants at Fort Dodge, Southard and Sweetwater and unduly preferential of the California producers; and that the grouping of Fort Dodge with Oklahoma and Texas producing points in the adjustment of rates on this traffic to destinations in California was unreasonabe and resulted in undue prejudice to the Oklahoma and Texas points.

Examiner Griffin said no finding was proposed with respect to rates on plasterboard from Fort Dodge, Southard and Sweetwater to points in transcontinental territory, as it appeared that the present adjustment from Fort Dodge to all Pacific coast ports and from Southard and Sweetwater to the south Pacific ports was satisfactory to both complainants and defendants. But he said the railroads should be advised that they would be expected to establish rates on plasterboard from Southard and Sweetwater to the north Pacific coast ports properly related to the rates from Fort Dodge; also to effect a readjustment of the rates from Fort Dodge, Southard and Sweetwater to points in intermountain territory that would properly relate these rates to western trunk line and Pacific coast points.

Examiner Griffin said the commission should find as follows:

1. That the rates assailed on plasterboard, in carloads, from Fort Dodge to points in western trunk line territory as defined in Appendix G to Western Trunk Line Class Rates, 164 I. C. C. 1, are unreasonable to the extent they exceed rates based on 20% of the corresponding first class rates.

2. That the rates assailed on plasterboard, in carloads, from Fort Dodge, Southard and Sweetwater to points in the southwest are not unreasonable.

3. That the rates assailed on plasterboard, in carloads, from Southard and Sweetwater to destination in western trunk line territory as defined in Upson Co. vs. Ann A. R. Co., 157 I. C. C. 586, to which the rates are based on 20% of the corresponding first class rates, are not unreasonable, but that the rates to other destinations in western trunk line territory as defined in Appendix G to Western Trunk Line Class Rates, 164 I. C. C. 1, are unreasonable to the extent they exceed rates based on 20% of the first class (column 100) rates under the southwestern scale set forth in Appendix 18 to the report in Consolidated Southwestern Cases, 123 I. C. C. 203.

4. That the minimum weights in connection with the rates on plasterboard, in carloads, from Fort Dodge, Southard and Sweetwater to points in western trunk line and southwestern territories are unreasonable to the extent they exceed 40,000 lb.

5. That in so far as it applied to mixed shipments of plaster and plasterboard the mixed carload rule assailed is not unreasonable. This finding should be without prejudice to further consideration following disposition of Investigation and Suspension Docket No. 3588, Plaster from the Southwest to Interstate Destinations.

Asks Equalization of Plaster Rates

CHARGING that its products are discriminated against through violation of long and short haul provisions of the public utilities act, the Standard Gypsum Co. of Long Beach., Calif., has filed complaint with the railroad commission against the Southern Pacific, Holton Interurban and the San Diego and Arizona railway.

Specifically the complaint alleges the Standard Gypsum Co. tries to sell its plaster at intermediate points between Beaumont, Calexico, Holtville and Plaster City, and in marketing and selling of these products in southern California, and particularly in the territory east of Beaumont and near Calexico, Holtville, it is in direct competition with a manufacturer of a similar kind of plaster located at Plaster City. Rate discrimination in favor of the latter plant is charged against the San Diego and Arizona railway and Southern Pacific in the application of an 11-c. tariff on plaster from Plaster City to Long Beach. It also is alleged that shipments destined from Long Beach to places east of Beaumont and intermediate points to Plaster City, Calexico and Holtville are charged for at the rate of 16½ c. for each 100 lb.

A similar condition is alleged to prevail with a plaster manufacturing company in Los Angeles. The railroad commission is asked to put an equalized schedule of rates into effect.—*San Diego* (Calif.) *Union.*

Ask Reduction in Rates on Aggregates

FOUR major companies engaged in the manufacture and marketing of crushed rock, sand and gravel, have filed a complaint with the California railroad commission asking that the freight rates on these products be reestablished at the rate prevailing before recent increases were allowed.

The Arrowhead district in San Bernardino county and points in 14 other counties are listed in the complaint as places where these shipments originate.

The complaint asserts the increase was allowed in order that intrastate rates might be adjusted to the increased interstate rates allowed by the Interstate Commerce Commission. The traffic in crushed rock, sand and gravel, the rock companies aver, is not in competition in any way with traffic moving interstate. It is also charged that the new rates will yield less revenue to the railroads than was received under the old rates.

The Santa Fe railroad is named as one of the defendants in the action, as is the Southern Pacific and several lines which do not penetrate this part of the state.—*San Bernardino* (Calif.) *Sun.*

Reduced Gravel Rates in Nebraska

REDUCED emergency gravel freight rates will be ordered into effect soon, C. A. Randall, chairman of the state railway commission, announced recently. The rates will not include absorption of the switching privileges.

The commission is awaiting slight modification of the applications by three railroads and applications of other Nebraska roads before ordering into effect the new rates, Commissioner Randall said. The modifications, he said, are designed to apply the same rates to a few pits missed in the first applications.

Word has been received by the commission that applications for similar reductions are on the way from the other railroads.

The reductions are expected to mean a saving to the state of between $150,000 and $200,000 on the state highway work this year, railway commissioners said. "Although the absorption of switching is not protected," Commissioner Randall said, "we cannot afford to deny the state this saving.—*Lincoln* (Neb.) *Star.*

Display Safety Trophy

THE SAFETY TROPHY to be awarded the Northampton, Penn., plant of the Universal Atlas Cement Co. will be displayed during the Midwest Safety Conference sponsored by the Chicago Safety Council which was held at Chicago, April 6-7.

Foreign Abstracts and Patent Review

Phenomena of Dehydration of Gypsum. R. Nacken and K. Fill present an extract from their book *Zur Chemie des Gipses* concerning phenomena in dehydration of gypsum. They describe their experiments proving that it is possible to dehydrate gypsum in air and at atmospheric pressure at room temperature provided the partial water-vapor pressure (humidity) of the air is so low that it can draw water from the gypsum. The results of the dehydration tests of others, which were carried out in presence of air without indicating the humidity of the air, are therefore to be accepted only as approximate values, which offer no direct proof. It is thus explainable why G. Linck and H. Jung could dehydrate gypsum in the dry chamber at 85 deg. C. The air in the dry chamber was not saturated with moisture and when with the increase in temperature the humidity of the air corresponded to the water pressure of the gypsum, the latter could give its water of crystallization to the air and change into semihydrate.—*Tonindustrie-Zeitung* (1931) 55, Nos. 73, 75, 76.

Belgian Cement. G. Baire reviews the Belgian cement industry, listing the manufacturing companies, outlining the purpose of the Belgian Cement Manufacturers' Association, and presenting the principal parts of the official Belgian specifications for artificial portland cement, including methods of testing. The composition of the Belgian clays used in the manufacture of cement varies ordinarily between 60 and 65% silica, 19 and 20% alumina, and 5 and 8% ferric oxide. The cements are classified as normal artificial portland cements (P. A. N.); high strength artificial portland cement (P. A. H. R.); and rapid hardening artificial portland cement (P. A. D. R.). Specifications provide that the cement shall contain not more than 3% SO_3 nor more than 3% MgO. The specific gravity must not be below 3.05. The set must not start before 45 min. On the 178-mesh (metric) sieve the maximum residue is not more than 18, 14 and 10%, respectively, for the normal, high strength and early strength cements. The minimum required strengths of normal pats are to be, in kg. per sq. cm., as shown in the table below.

—*Revue des Materiaux de Construction et de Travaux Publics*, 256, 1931, pp. 17-21.

Time of storage.....	1 day (moist air) Strength		3 days (1 moist air, 2 water) Strength		7 days (1 moist air, 6 water) Strength		28 days (1 moist air, 27 water) Strength	
Artificial portland cement	Tensile	Compressive	Tensile	Compressive	Tensile	Compressive	Tensile	Compressive
Normal	....	.....	....	.....	18	200	23	300
High strength	....	.....	23	300	25	400	30	500
Early strength	20	225	25	400	30	500	32	550

Examination of Alit. I. Weyer reviews first the results of researches on the occurrence and definition of alit in cement clinker made by Le Chatelier, Toernebohm, Rankin, Bates, Klein, Phillips, Richardson and Kuehl. One group requires the complete optical identity between alit and tricalcium silicate and the other group demands proof of some kind of mixed crystal formation between $3CaO \cdot SiO_2$ and $3CaO \cdot Al_2O_3$. An exact knowledge of the pure compound $3CaO \cdot SiO_2$ is equally important for both groups to provide an experimental basis for proof of either theory. Recent optical and x-rayographic data has characterized the compound $3CaO \cdot SiO_2$ satisfactorily and sufficiently for an approach to a decision on the problem. Due to considerable quantities of Al_2O_3, as much as 8%, and other conditions, Guttmann and Gille were forced to consider alit as a mixed crystal primarily of $3CaO \cdot SiO_2$ and $3CaO \cdot Al_2O_3$.

The author made it his problem to bring together tricalcium silicate and tricalcium aluminate in various proportions at high temperatures and to decide by optical and x-rayographic examinations and also by color if it would be possible to recognize that any quantities of $3CaO \cdot Al_2O_3$ could enter the tricalcium silicate. X-rayographic diagrams of homogeneously mixed compounds of $3CaO \cdot SiO_2$ and $3CaO \cdot Al_2O_3$ taken before and after the burn conformed completely with each other and contained only the lines of $3CaO \cdot SiO_2$ and $3CaO \cdot Al_2O_3$, even when the mixes contained less aluminate. A mix of $3CaO \cdot SiO_2$ and $3CaO \cdot Al_2O_3$ in the proportion of 10 : 1 was made first by mixing these two compounds, and second by weighing in quantities of oxide corresponding to these conditions. This resulted in identical x-rayographs. In all three mixes the 10.58% of $3CaO \cdot Al_2O_3$ has the same number of reflexes and the same intensity and the lines of the tricalcium aluminate do not disappear, but would disappear if mixed crystals in the form of tricalcium aluminate were formed. With a content of $3CaO \cdot Al_2O_3$ of 6.89% or less, the compound $3CaO \cdot Al_2O_3$ can no longer be detected. From these x-rayographic examinations it can be concluded that quantities of tricalcium aluminate possibly entering into combination with tricalcium silicate can at the most amount to only 3%, if the detection of the tricalcium aluminate is accepted under most favorable circumstances at a content of about 7.5%, which would correspond to an alumina content of about 1%.

Microscopic examination of the mix of $3CaO \cdot SiO_2$ and $3CaO \cdot Al_2O_3$ burned in different proportions showed that the tricalcium silicate undergoes a recrystallization in the fused mass of aluminate. The refraction of light, and the other optical and crystallographic data of this recrystallized tricalcium silicate are like those of the pure compound. It can still be detected with some effort in the 16 : 1 mixture. According to the microscopic examination, the quantity of $3CaO \cdot Al_2O_3$ which under favorable conditions can be considered for a formation of mixed crystals with tricalcium silicate, must be below 6%.

Various coloring processes applied by the author makes it appear impossible to detect small quantities of alumina contained in any form in the tricalcium silicate. In all cases, however, only a limited proof can be accepted of this method towards the decision under consideration.

In conclusion, it can be said that one must recognize in alit the principal mineral and carrier of the hydraulic properties of the portland cement clinker as practically pure tricalcium silicate. Besides the results of the x-rayographic examinations and the coloring method, the complete crystallographic and optical agreement of the synthetic alit with the pure tricalcium silicate is sufficient proof for this view. This statement is supported by the recently published data of Guttmann and Gille, which shows that the chemical composition and the fine structure of the alit correspond essentially to that of pure tricalcium silicate. The refractive indexes determined by Weyer for the first time on pure tricalcium silicate conform so well with those obtained by Guttmann and Gille from data on alit crystals of alumina-fat clinker, that it appears rather doubtful whether the theory of the mixed crystal formation of the alit can still be maintained, while the theories of recognizing alit as a compound of β $2CaO \cdot SiO_2$, and of the "true" alit or mixed crystals of $2CaO \cdot SiO_2$ plus considerable quantities of $8CaO \cdot 2SiO_2 \cdot Al_2O_3$ likewise correspond no longer to the present state of research on alit.—*Zement* (1931) **20**, 5, pp. 96-100.

Formula for Artificial Marble. Fritz Rosenberg, Berlin-Dahlem, and Hans Finck, Berlin-Britz, have obtained German Patent 531,140, covering the making of artificial marble. Ten kilograms of finely ground gypsum is divided into three piles. To the first pile is added about 0.75 kg. air-dry, slaked or hydraulic lime. To the second

pile is added finely divided alkaline earth carbonate, for example, 0.75 kg. of precipitated calcium carbonate. The third pile remains pure. Each pile is then well mixed with water, after which the three piles are combined and kneaded coarsely for a brief period so that there remains an unevenness in the mass which is then placed on smooth forms. This mass is at first white. The finished molds are then dipped in a saturated solution of iron sulphate for 2 to 5 min., depending on the tone desired; and are then dried at air temperature. Patterns of natural marble effect are thus secured by the coarse kneading, and a portion remaining white and the other slightly colored. Earthy colors may be added to obtain base tones of color.—*Baumarkt* (1931) **30,** 42, p. 1138.

Reactions in Setting of Cement. A. Guttmann describes a new method for investigation of the reactions in the setting of cement; which consists in the preparation of slides of 5 micron thickness of setting cement samples embedded in paraffin by aid of the Reichert freezing microtome, so that magnifications of up to 1200 times may be observed.—*Tonindustrie-Zeitung* (1931) **55,** 94, pp. 1297-1299.

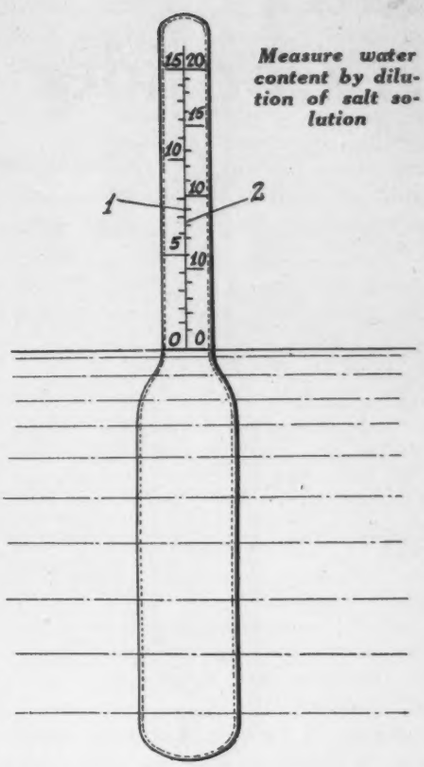
Recent Process Patents

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Commissioner of Patents, Washington, D. C., for each patent desired.

Washer. A device which the inventor says is designed for washing coal but which may be applied to other materials, is really a hydraulic classifier. The material to be treated comes through the gate shown at the left, adjusted to the capacity of the apparatus, and flows over an inclined screen in a tank of water. Water under pressure enters the tank below the screen and rises through the screen, lifting the lighter particles. These go over a partition and into another compartment from which they flow out with the water through a chute. The chute has a screen in the bottom through which the water and sludge escape. These are caught in the hopper-bottom tanks shown at the lower right. The sludge settles and the water overflows and goes back to the supply tank to be used as before. The heavy particles in the feed cannot rise to go over the partition and follow down on the screen until they come to a gate through which they pass into a compartment from which they are removed by an elevator or drag conveyor.—*William C. Menzies, U. S. Patent* 1,790,107.

Coloring Slate Granules. The process consists in heating the slate granules with compounds of two or more metals to form hydroxides in a colloidal form and then to heat to convert the hydroxides to oxides, one of the salts being in excess of the combining proportion. As an example, to make a seal brown color, the inventor mixes the slate with a water solution of sodium dichromate and sulphate of iron and then passes it through a roaster where it is agitated and raised to a glowing heat. He claims that the result is to form hydroxides in a jelly state and these appear to pass through a stage during which the penetration into the slate is increased. After this stage the hydroxides are dehydrated, leaving the oxides of the two metals. The color may be varied and controlled in various ways. If the atmosphere is oxidizing the color will tend to a reddish brown. If steam or sulphur dioxide is introduced tending to prevent oxidation, the color will be yellowish.—*Harry C. Fisher, Assignor to the Phillip Carey Manufacturing Co., U. S. Patent* 1,782,648.

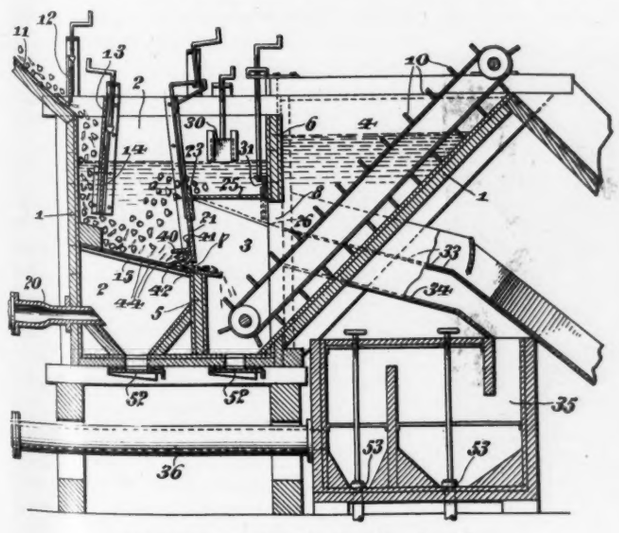
Method for Measuring the Amount of Water Contained in Moist Sand or Gravel. The method is that of putting a sample of the moist sand or gravel in a solution of common salt of known strength. The moisture in the sand or gravel will dilute the solution and the amount of dilution will be shown by a hydrometer. The inventor has devised the special hydrometer shown



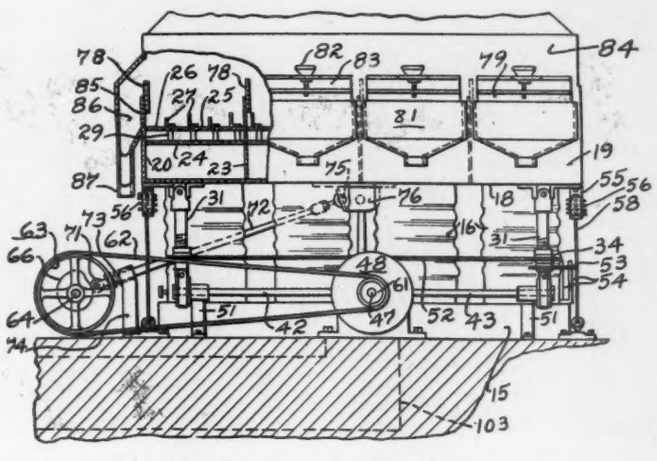
Measure water content by dilution of salt solution

which, with given weights of sample and solution, has a scale for moisture by volume and a scale for moisture by weight.—*Tappan Collins, U. S. Patent No.* 1,806,538.

Dry Separator. The invention shown is really a pneumatic jig, a device in which the fine material is subjected to vibration and the effect of a current of air that rises through a perforated bottom. The body of the machine is divided by partitions into fairly deep compartments. A reciprocating motion causes the lighter part of the material to overflow the partitions while the heavier portion goes to a discharge, or the discharge may be of the light material while the heavy goes under the partition for further treatment. The system of vibrating and shaking the material is said to be especially efficient in promoting stratification.—*Martin Lide, U. S. Patent* 1,813,303.



Could be used as hydraulic classifier



Vibration plus air currents make separation

Consider Safety at Kansas City

Cement Mills of That Region Hold Largest Meeting

ONE HUNDRED enthusiastic members of cement mill operating forces met at the Kansas City, Mo., Athletic Club on March 15 for the largest regional safety meeting the Portland Cement Association has ever held in that section.

The attendance included representation from the Ash Grove Lime and Portland Cement Co., Chanute, Kan., and Louisville, Neb.; Lehigh Portland Cement Co., Iola, Kan.; Lone Star Cement Co., Bonner Springs, Kan.; Missouri Portland Cement Co., Independence and St. Louis, Mo.; Monarch Cement Co., Humboldt, Kan.; Nebraska Cement Co., Superior, Neb.; Pennsylvania-Dixie Cement Corp., Des Moines, Ia.; Universal Atlas Cement Co., Hannibal, Mo., Independence, Kan., and Watonga, Okla.

Officials of the U. S. Bureau of Mines and the Kansas City Safety Council cooperated in arranging for the meeting and appearing on the program. A number of local cement company officials and guests of local prominence were also present. A. K. Frolich, superintendent of the Ash Grove plant at Louisville, acted as general chairman and was assisted by a general committee of plant superintendents. C. N. Carman, superintendent of the Universal Atlas plant at Independence, presided at the afternoon session. E. Struckman, general superintendent of the Lone Star company, was luncheon chairman, and C. A. Swiggett, superintendent of the Lehigh mill at Iola, was toastmaster at the dinner. Baxter D. McLain, prominent Kansas City lawyer who has been associated with the development of the cement business in Kansas since its inception, spoke at the dinner.

The Program Presented

The meeting was opened by Chairman Frolich who introduced Stanley Owens, safety engineer, Portland Cement Association. Mr. Owens reviewed the 1931 record after which a symposium was held on "How We Won the Safety Trophy" by M. L. Silcox, chief chemist, Pennsylvania-Dixie Cement Corp.; C. M. Carman, superintendent, Universal Atlas Cement Co., and D. W. Webb, chief draftsman, Ash Grove Lime and Portland Cement Co.

Following this a paper, "Recent Developments in the Prevention and Control of Infections," by Dr. C. O. Sappington, director, division of industrial health, National Safety Council, was read by Dr. Fred Candler of the Lone Star Cement Co., Kansas.

Another paper, "Eye Protection," was read by J. G. Stadler, Lehigh Portland Cement Co. Papers were also read by W. D. Ryan, United States Bureau of Mines, on "Discussion of First Aid Problems"; by C. P. Mitchell, superintendent, Monarch Cement Co., on "Fires, Their Cause and Prevention"; by Raymond L. Atkisson, storekeeper, The Lone Star Cement Co., on "Man and Machine"; and by F. J. Davis, director, safety and labor, Universal Atlas Cement Co., on "Eliminating the Minor Accident in the Mills and Quarries by the Member Companies of the Portland Cement Association." Interesting discussion followed each of the papers presented. The meeting ended with a banquet at which the "Lehigh Four" male quartet provided entertainment.

During the banquet of the Kansas City safety meeting

Controllable Causes of Fire

NEGLECT, carelessness, willfully, and the terror of trying to "get by" were attributed by C. P. Mitchell, superintendent, Monarch Cement Co., as controllable causes of fires in a paper read at the Kansas City regional meeting of the Portland Cement Association recently.

The first two of these can be avoided by being careful and by the cooperation of employes and management in the proper spirit. Fires set willfully will have to be worked out by the management and the men in charge, he said.

As to the terror of trying to "get by," he said that sometimes the management feels that it cannot invest in proper equipment. This may result in the employes taking the attitude that if the company does not care why should they. He then pointed out that a fire might cause all employes to be out of a job through their own carelessness and for this reason alone that it behooves the employes to use the utmost care in preventing fires.

He called attention to the fire hazards from handling various types of fuel in the manufacture of cement and gave various precautions in handling these fuels. In summarizing his talk he recommended that the proper fire equipment be kept; that daily inspection of all equipment where fire hazards exist be made; that employes be educated in the matter of fire hazards, and finally that buildings be of concrete to eliminate fire hazards.

Reduce Accidents with Blasting Caps

FIGURES available for the year 1931 show a decrease of 10% in the number of blasting cap accidents to children, as compared with the preceding year. It is hoped that an even greater reduction can be made this year. The Institute of Makers of Explosives is now making another appeal to all those who use blasting caps to see that they do not fall into the hands of children. At this time of the year these accidents tend to show an increase due to the fact that children play more out of doors. The campaign to warn children of the danger of playing with blasting caps, and adults of the danger of leaving the caps where children might find them, was started five years ago. It has been participated in by trade papers, newspapers, press associations, Boy Scouts, Girl Scouts, school authorities and many other organizations.

More Rock Products Freight Rate Increases?

(Contributed)

ALTHOUGH it is not generally known, and where known it is not sufficiently appreciated, the railroads east of the Mississippi and north of the Ohio rivers have launched a movement which will substantially affect the freight rates of all of the producers of crushed stone, sand, gravel and slag if the action is successful.

This maneuver should not be permitted to go unchallenged for these commodities are now, in the majority of instances, paying more than their fair share of the transportation burden of the nation.

A petition by the railroads filed with the Interstate Commerce Commission designated I. C. C. Docket No. 25020 and set for hearing at Columbus, Ohio, April 11, before representatives of the Interstate Commerce Commission and the Public Utilities Commission of Ohio asks these commissions "to institute an investigation and after due hearing and investigation to enter an order forbidding the preferences and discriminations—by requiring your petitioners to establish and maintain for the intrastate transportation of crushed stone, gravel, sand and slag from and to points in the state of Ohio rates and charges equal to the western Pennsylvania scale with the addition of the joint line arbitraries therein prescribed."

This petition is filed in behalf of all railroads operating within the confines of the state of Ohio. It is tantamount to a general revision of the entire rate structure of the state in so far as it concerns the designated commodities.

The position of the railroads in general with respect to this proposition is that the freight rates on these commodities which they are required to maintain are subnormal and give undue preference to the commerce of the state of Ohio to the prejudice of interstate traffic.

In the body of the petition numerous instances are cited of rates on crushed stone, slag, sand and gravel which are maintained by them voluntarily to meet competitive conditions or established by the constituted regulatory bodies which are less than the rates that would result from the application of the interstate or Western Pennsylvania scale.

The substantial character of these increases is sufficient to indicate the trade menace if the revision should become effective.

Basis of Railroads Petition

Section 13 of the Interstate Commerce Act prohibits preferences of any sort being set up or accorded to state traffic by any of the commonwealths of the nation to the prejudice of interstate commerce. The Interstate Commerce Commission is directed by congress to terminate such conditions whenever and wherever they are found to exist.

This is the basis of the railroads' petition. Therefore if the railroads should sustain their contention the Interstate Commerce Commission is required and empowered to order into effect whatever level of rates they may deem to be reasonable and just.

Under the administrative rulings of the Public Utilities Commission of the state of Ohio the rates on the commodities involved have been unified (1) as to the commodity application of rates, the Ohio commission refusing to sanction any different level of rates on these commodities based upon commercial or industrial employment; and (2) as to their applicability over lines of railroads, no distinction in the rate being made whether the haul is a single line or over two or more lines of railroad.

For box car shipments, the railroads were permitted by the Ohio commission to make rates on such traffic 115% of the standard or open car rate.

The order of the Interstate Commerce Commission in the Western Pennsylvania case is construed by the carriers to apply only upon road-making materials. Stone, gravel, slag or sand having other industrial usages are excluded from the application of the road-making materials scale and would be charged for on a substantially higher basis.

In a case now pending the railroads have *generously* proposed that the rates on glass sand, molding sand, filter sand, etc., be made 16% of the first class rates recently prescribed by the Interstate Commerce Commission.

The "West Penn" scale also provides for a distinction as between single- and multiple-line hauls or carriage; the latter being uniformly 20c. per net ton higher than for comparable hauls over single lines.

The "West Penn" scale is one of the highest, if not the highest, that has been prescribed for general application anywhere within the United States, regardless of the fact that transportation and traffic conditions ordinarily observed in connection with rate making policies do not warrant such a condition.

It is quite apparent from this proceeding that the railroads are endeavoring to take advantage of this situation, while they may, and that they are endeavoring to unify the freight rate structure of this region by establishing for both state and interstate application this high "West Penn" scale.

The "West Penn" scale is the result of a proceeding instituted by the Pennsylvania Sand and Gravel Producers Association against the Baltimore and Ohio railroad and others.

As this complaint made its appearance upon the docket of the federal regulatory bodies it seemed to be an isolated complaint involving a limited origin and destination territory and there was nothing to distinguish it from thousands of other reports or complaints which concerned only the principals involved in their institution. To a large extent the sand, gravel, stone and slag interests ignored the issue as one in which they were not concerned with a result that while the complainants in that local proceeding obtained what they were at that time satisfied with, the industry is now threatened with the application of that basis of rates to three-fourths of the sand, gravel, stone and slag production of the nation.

Had the industry, at the time this isolated complaint was filed, even remotely surmised that this proceeding would result in a scale of rates which would be adopted as a proper yard-stick by which to test the reasonableness of all other rates throughout the territory it is proper to assume that the industry would have manifested an entirely different attitude, a result of which would have been the adoption of an entirely different rate basis.

This, however, is no time for speculation. This industry is confronted with an actuality and it is quite logical to assume that, being successful in this venture, the carriers in turn will file similar applications and will in turn adjust the prevailing rates in other states to conform to whatever rate level may be determined

REPRESENTATIVE OF RATES THAT ARE LOWER THAN PROPOSED SCALE

Commodity	Origin	Destination	Miles	Rate Published	West-Penn Single-Line Scale
Slag	Youngstown	Warren	14	$0.40	$0.60
Gravel	Lorain	Cleveland	25	.60	.70
Stone	S. Lebanon	Cincinnati	31	.40	.70
Slag	Youngstown	Cleveland	66	.80	.90
Stone	N. Baltimore	Berea	131	.90	1.20
Sand	E. Liverpool	Cleveland	104	.90	1.10
Stone	Carey	N. Randall	182	.90	1.40

by the Interstate Commerce Commission in this proceeding.

Therefore the present proceeding cannot be passed over as a localized one, concerning only Ohio state shippers, but one that directly affects every producer and shipper of sand, gravel, stone and slag east of the Mississippi river.

This Issue Is Important

The serious character of this issue cannot be over-emphasized; the very life of many of the producing companies hangs in the balance and depends upon its adjudication. The single and joint haul basis of rates is especially pernicious. Taking a competitive market served by both single and joint haul shippers it is quite obvious to thinking men that, under any conditions, the present least of all, it would be utterly impossible for the joint haul shipper to accord his single line rival a rate advantage of 20c. per ton and retain or develop any patronage at such markets.

The inevitable effect of such a proposal would be to localize a producer's business to possible receivers located upon the same railroad or railroad system as himself.

It is to be hoped that the attitude of the industry in connection with the Pennsylvania Sand and Gravel Producers case will not be repeated in connection with the new issue but that the industry will be generously and competently represented and that the resultant decision of the regulatory agencies will reflect the best judgment of the industry as a whole.

Considers Motor Vehicle Transportation

A HEARING of considerable economic significance to the rock products industry is now in progress before a senatorial committee on interstate commerce in connection with senate bill No. S2793, which relates to government regulation of transportation facilities, and more particularly to regulation of trucking as a competitor of railroads.

In connection with this hearing, briefs and testimony have been presented by many industries and organizations. Testimony relating to truck transportation and its effect on the rock products industry has been given by several.

Representing no particular group but presenting the views of a number of interested parties, James Bale, secretary, Grand Rapids Plaster Co., Grand Rapids, Mich., submitted a report in which he pointed out the unstable and dangerous competitive conditions which result from lack of control over truck transportation. The economy of distribution through local dealers was emphasized. The unjust position in which they are placed by unrestricted truck transportation was shown. He also spoke of the importance of railroads to the entire country and suggested that a charge for the use of public roads by private interests for profit is comparable to the charge made by local municipalities for franchises. In applying a charge he suggested that it be made for the use of public highways applicable to all trucks over 1½ to 2 tons capacity.

F. E. Paulson, vice-president, Lehigh Portland Cement Co., representing the portland cement industry, recommended that the bill be amplified to provide for the publication and filing of tariffs setting forth the rates and charges of common and contract carriers. He described the nature of the cement business and how it had built up its distribution system on the basis of regulated rates. As stability of transportation cost disappeared, so also did stability of price in the cement industry. With the change in transportation costs to a condition of chaos, orderly marketing has given way to demoralization. He said the cement industry believed that the same reasons that induced Congress to enact laws requiring that railroad rates be fixed, open and nondiscriminatory should induce similar legislation in relation to highway transportation.

W. W. Campbell, president, National Builders Supply Association, asserted that trucking was "one of the major causes for the chaotic condition existing in the construction industry today. The construction industry must have a regulated and stabilized charge on which it can stand, he stated.

There was much other testimony to show the importance of stabilized transportation, while problems that cause difficulties in establishing regulation and stabilization that will at the same time effectively solve the problem were brought out, and the difficulties that would result if so called "bootlegger" were not controlled as well was stressed.

Denied Rerouting of Road to Pass Sand Pit

THE Bridgeton Sand Co., of which George F. Pettinos, Inc., Philadelphia, Penn., is owner, has been denied its request to reroute a road to pass its silica sand operation at Blue Anchor, N. J. It was claimed the sand could be dredged out of the deposit without injuring the road or landscape, the *Camden* (N. J.) *Post* reports.

Barite and Barium Products in 1929

A REPORT issued by the Bureau of Mines gives general information about barite and barium products and discusses economic considerations.

Report Lease for Lime Kiln

UNCONFIRMED REPORTS are that the A. and W. Lime Co. will install a lime and cement plant seven miles out of Comanche, Tex.

H. G. Ainsworth, representative of the A. and W. Lime Co. of Lubbock, Tex., has leased from Mrs. Hansard her 300-acre farm, the contract calling for a payment of 12½c per ton of lime turned out and $25 per month after the plant starts operation for the time that the mine might be closed down, it is reported locally.

Hugh Lacy reports that he signed a contract giving the A. and W. Lime Co. an option on five acres of land at $40 per acre, the land to be used to build a spur from the Frisco railway to the mountain.

Work will begin on installing the machinery around April 1, Mr. Ainsworth told Mr. Lacy and the construction will be pushed to completion as rapidly as possible.

It is the plan of the company to install four kilns for lime with a capacity of 200 tons per month and also later to install a cement plant, Mr. Ainsworth said. He said that the plans call for night and day shifts.

The Logan Gap Mountain which the company proposes to develop is said to have one of the richest limestone ledges in this section, some of which crops out at the surface and measures to a depth of 20 ft.

The late L. C. Boynton operated a small lime kiln just across the road from the proposed location for about 30 years from the seventies to about 1900.—*Comanche* (Tex.) *Chief*.

Opens Quarry in Massachusetts

THE L. Suzio Trap Rock Co. began operations in a quarry just established at the Agawam-Southwick town line on March 28. Preliminary operations have shown this quarry to compare favorably with any in New England, according to officials of the company, who point also to the location as being favorable both in regard to adjacent roads and to its situation near numerous communities of western Massachusetts.

Leonard Suzio, for whom the new quarry has been named, has had 35 years' experience in this line of work and for 21 years has operated the York Hill quarry at Meriden, Conn. His desire to extend these operations led to a survey of this territory and tests of the Feeding Hills quarry showed an excellent analysis. Electric power has been provided, new equipment has been installed and more than 25 men will be employed.

John R. Driscoll of Longmeadow is affiliated with the new venture and will supervise distribution, sales and service throughout this section. Mr. Driscoll has been associated with the construction and building material industry for the past 21 years and is widely known in the territory he will serve.—*Springfield* (Mass.) *Union*.

You Must Keep Up Fight Against Gasoline Tax Diversion

Politicians Are After Funds Irrespective of Road Industry's Plight or Motorists' Rights

IT HAS REQUIRED many years to develop basically sound and orderly methods for financing highways, to perfect suitable types and standards and to organize an industry capable and proficient in the art of modern highway building. The results have not only proven highly satisfactory to our road users and gratifying to our road builders but they have attracted the admiration of the civilized world.

After several years' trial the tax on gasoline remains at the head of the list as the tax levy which has proven most dependable and has produced its yield with little, if any, opposition. That is because it is recognized as equitable—a tax levied for a needed improvement and collected from the road users according to the extent of their use.

The popularity of this tax today is built entirely upon its obvious fairness as a road revenue measure; its diversion to other purposes throws it into the category of iniquitious class legislation and dooms it eventually to certain discard—unless this diversion is immediately halted.

Any step, anywhere, at this time to divert funds normally applied to road building will be disastrous and our lawmakers should be impressed with this fact in terms which cannot be misunderstood. Such a move will increase unemployment in the industries that do the building and likewise in those that supply and transport the materials. A thousand dollars diverted decreases the wage item by $910 and withholds $1000 worth of roads for which motorists have paid. Yet with little concern for the welfare of the road-building industries or for the rights of the payers of the gasoline tax, plans are developing in many states and at Washington for the diversion of these highway funds on a grand scale.

Federal Gas Tax Proposed

A few weeks ago congressional committees working on revenue schedules became noticeably enthusiastic over the prospects of a federal gasoline tax of 1c. per gallon, to be used for general purposes of government. No pretense was made that it was fair; proponents merely urged that it was collectible.

However, such a blast of protest reached Washington within a few days from every section of the country that the plan had to be discarded, at least temporarily; apparently it is still regarded by its sponsors as too good to be abandoned at once, and there is a popular suspicion that it may be brought out again at some favorable opportunity.

A federal gasoline tax would weaken state gas taxes and add to the difficulty of collecting highway income from this source. Any further attempt to pass federal legislation of this sort should meet the determined opposition of every man connected with the rock products industry, every automobile owner and every believer in fair play and government according to equitable principles rather than by political expedient. If you are such, then express yourself to your senators and congressmen and appeal to your governor also to do so.

Let the Road Funds Alone

THE WISDOM of the General Assembly of Georgia in refusing, at its last session, to divert the state highway funds to other purposes has been confirmed by subsequent events and is endorsed today by the country's most competent opinion. Left undisturbed, those funds are procuring for the commonwealth bargains in road construction such as never were known in the past and probably will not recur in the years ahead. They are also providing employment for many workers who otherwise would be without means of a livelihood. Further, they are speeding toward completion a system of modern highways that will save the people hundreds of millions of dollars in traffic costs and prove a potent factor for economic and social progress.—Atlanta Journal.

States Raid Road Funds

Fortunately we believe for highway finances, this is an "off" year for state legislatures. Nevertheless, activity at some of the special sessions has produced disastrous results. The popular cry at the moment is for funds for relief; many legislators have the mistaken idea that the surest method of raising such a fund is through raids on highway revenues. But quite aside from the question of fairness what can be said for the efficiency of a scheme which selects highway funds normally providing $90 worth of productive jobs for each $100 spent, in order to provide charity, in the administration of which we are told that normally only $85 out of every $100 can go for actual relief?

ILLINOIS furnishes an interesting story. The legislature recently authorized the sale of $18,750,000 worth of tax warrants to provide funds for the relief of the unemployed on a charity basis. These warrants bear interest at the rate of 6% for one year. If the entire issue is sold, warrants and interest will cost $19,875,000. The legislature proposes to cover this item with a bond issue financed out of the counties' share of the gasoline tax proceeds.

An immediate withdrawal of gas tax funds for this purpose might encounter the opposition of labor because of its obvious effect on employment; hence the understanding that gasoline tax revenues should not be disturbed until 1934. Under these circumstances the cost of the bond issue should be about as follows, assuming a 4½% interest rate and sale of all of the bonds:

Bond principal	$20,000,000
1933 interest	900,000
Interest to complete repayment in 20 years	9,405,000
Total cost	$30,305,000

According to these figures, the sum made available for charity is about 61% of the indicated cost to the motorists. The $30,000,000 thus spent would probably cover a wage and salary item as high as $27,000,000 if expended normally over the period of the issue and during that period it *would be paying for the equivalent of more than* 1200 *miles of modern concrete highway.* This plan calls for an average diversion of over $1,500,000 per year for 20 years, the maximum in 1934 probably amounting to at least $2,000,000.

Other States Face Diversions

In *NEW JERSEY* a senate bill now pending would increase the diversion of gasoline tax funds for inland waterways from $90,000 to $200,000 annually. Another bill also pending in the state senate seeks to give the Department of Inland Waterways a straight 3% of current gasoline tax income.

Motordom, the journal of the New York State Automobile Association, gives a terse but enlightening account of what is going on in that state in its March, 1932, number:

"What the reduced highway budget does in contrast to the increased gas and motor

vehicle taxes, as now estimated, is shown at a glance as follows:

GAS TAX AND MOTOR VEHICLE REVENUES

1930	$69,500,000
1931	71,000,000
1932 (est.)	97,000,000
1932 highway expenditures—	
State	$28,750,000
Counties and New York City (from gas funds)	20,500,000
Total	$49,250,000

"Subtracting the $49,250,000 from the $97,000,000 leaves $47,750,000, which is gas and motor vehicle fee money *diverted* from highways. In 1931 the state spent $59,000,000 on highways. In 1932 it will spend $28,750,000, or $30,000,000 less."

Bills before the *KENTUCKY* legislature would reduce state highway income by $7,800,000 annually, over $6,000,000 of this sum through the diversion of gas tax and other highway funds. In *TEXAS*, where the gasoline tax was recently advanced from 3 cents to 4 cents per gallon and 1 cent per gallon diverted to schools, the proposal is heard to increase the tax to 6 cents. Of the latter amount, it is proposed that 3 cents be applied to retirement of county bonds, 1½ cents be given to the school fund and 1½ cents go to the state highway department. Should this plan carry, consumption of gasoline will be decreased according to the experience of other states under similar conditions, and although the tax paid by the motorist will have doubled within recent months, the portion escaping diversion and finally becoming available to the state highway department will have been cut more than 100%.

Continuing down the long list of states, scarcely a commonwealth but is now diverting or actively planning to divert millions of dollars of gasoline tax money to purposes other than the improvement of highways, to which every dollar of it has been solemnly committed. In one state it is proposed that public improvements (of which highway construction is the principal item) be suspended for two years but that the gas tax and motor license proceds be collected as usual and applied to general funds. In another, it is proposed to "borrow" several millions of gas tax money for repayment in the indefinite future. Many other plans are offered. Each exhibits individual characteristics but all are alike in that they provide for retaining or increasing the tax without providing the roads. The motorist is to be taught to give without receiving and the highways industries to stand by while a large proportion of their 3,000,000 men are deprived of their livelihood.

Developments in these raids on highway revenues should provide cement, sand, gravel, stone and asphalt producers as well as motorists with plenty of food for thought. Highway contractors may well take heed. The danger is not theoretical or speculative—it is real, and the proponents formidable and, in some cases, desperate.

Powerful political machinery will be hurled into the fight. The issue involved is whether the enormous funds raised for highway construction by means of the tax on gasoline shall be spent through the often wasteful and overlapping functions of government or whether the motorist's dollar shall continue to return to him a dollar's worth of roads and in that way to support legitimate industries developed to provide for modern highway needs.

Gasoline tax receipts in 1931 aggregated $542,000,000—almost equal to the federal income tax. The gasoline tax has been carefully gaged to highway needs and the diversion of even relatively small sums must affect highway programs in proportion. Some of the diversion plans of which the public has heard would not only upset the orderly completion of important projects now in process but would sacrifice expensive preliminary work. It would fall as a heavy blow on the road building industry, causing large financial losses to the latter and distressing unemployment to hundreds of thousands of wage earners.

The public may well view with alarm any plan to "switch" its funds (from capital account to operating expenditures) which will prevent it from taking advantage of the greatest road bargains of a generation. With highway costs 15 to 25% below 1929-1930 figures, every gasoline tax dollar diverted from highway use shamefully deprives the taxpayer not only of $1 worth of roads but of the greater money's worth which is purchasable under present conditions.

Motorists, through their organizations and as individuals, must fight for their rights. If the diversionists are allowed a free hand, the road-building industries will lose a substantial part if not the major share of their income.

Public Sentiment Against Looting of Highway Funds

D. H. Lafferty, president of the California State Automobile Association, said recently:

"Car owners in California pay $45,000,000 annually in gasoline tax, registration and other fees. This great sum is being expended in a carefully planned program of construction and maintenance of highways and their policing. This work provides employment to many thousands and it has already been accelerated as a means of meeting the unemployment problem.

"The motor car has long since ceased to be a luxury. It is now a practical necessity, as an essential means of transportation and a vital factor in modern business as well as social life. It should not be singled out for unjust and discriminatory taxation and made to pay for burdens that properly should rest on the community as a whole."

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"Any proposal to increase the gasoline tax for any purpose other than the one for which this impost was originally designed is dangerous. The gasoline tax is paid by the motorists for the building and upkeep of the roads they use."—*Milwaukee Journal.*

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"It is deeply important to safeguard the state's pledge to the motorists when the gas taxes were imposed, that they would be used only for the roads which the motorists use. There is no fairness otherwise."—*San Francisco Chronicle.*

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"Heretofore it has been the [petroleum] industry's policy not to oppose gasoline taxes when revenue was used only for road construction and betterment, and when the tax rate was not disproportionate to the price of the product. But in an effort to obtain revenue for general and special purposes, lawmakers almost everywhere seem to be turning thoughtlessly to increased gasoline taxes as the easy way to procure additional income. It seems to me that the time has come for every man connected in any way with the oil business personally and persistently to become militant and vocal."—American Petroleum Institute.

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"A vicious proposition has been advanced—no less than that of taking from the receipts of the gasoline tax some $8,800,000, and from the truck and bus franchise taxes about $1,500,000, and applying these funds to general purposes.

"In other words, it is proposed to repudiate the pledge made to the taxpayers that these extraordinary levies would be held sacred for highway uses, and by that repudiation penalize the motoring public for the benefit of enterprises now being rightfully financed by general taxation."—*Los Angeles Herald and Examiner.*

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"The mere fact that the Florida state senate voted in favor of an 8-cent gas tax (to permit certain diversions) shows the length to which politicians will go in their endeavor to extract money by special taxation from one class of people or industry."—*Murray* (Utah) *Eagle.*

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"Here are the two great imminent dangers of the gasoline tax. One is to increase the amount until it is out of economic proportion to the cost of fuel; the other is to use a special tax, levied against a certain portion of the population, for general purposes. When these are done, the tax becomes unfair, confiscatory and an obnoxious example of class legislation."—*Ashland* (Ky.) *Independent.*

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"I believe that in this time of crisis every citizen should freely and frankly state his opinion. It is only for this reason that I have attempted to explain my reasons for opposing a diversion of the segregated road funds for other purposes. I am concerned because the proposal made is fundamentally unsound and will bring into unpopularity the sources of road revenue, thus greatly in-

juring future road development and ultimately failing to benefit the agency of government to which the diversion is made."—Ex-Gov. Harry F. Byrd in *Richmond* (Va.) *News-Leader.*

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"Highway expenditures are not a 'cost of government'; they are for improvements aided by all and essential to the life of the state. The pay-as-you-go plan lays no burdens on the property of today or tomorrow. The disbursing of 85% of these millions to the ultimate laborer pays but does not increase taxes. An alert public opinion will continue to assure an undivided gas tax to the highways . . . ."—Col. Walter E. Garrison, director of Public Works, California.

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"Although the chief executives of the seven larger cities of Ohio have agreed that the diversion of a large percentage of the state share of gasoline tax to direct relief is the solution of the problem, we are inclined to agree with the governor that this is impractical.

"Of course there is truth in the statement of Mayor Miller of Cleveland that 'it is more important to feed hungry citizens than to build them good roads.'

"But we fail to see how the diversion for direct relief of money now being used to pay men to build roads would be of any net benefit in solving the unemployment problem of the state as a whole."—*Cincinnati* (Ohio) *Post.*

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"We pay for good roads whether we have them or not, and we pay less if we have them than if we do not have them. It is clearly desirable to speed up highway construction, so that the indirect travel costs of poor roads, which, in many cases, reach amazing proportions, can be eliminated. The gasoline tax was built up by motorists as a powerful weapon to combat the bad-roads tax. Faith can't be kept with him by diverting his contribution to other ends."—*Atlanta* (Ga.) *Journal.*

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"Recently a certain state legislature, in extra session, looking about for funds to pay a state indebtedness that had nothing to do with roads, passed legislation that diverted at once $1,200,000 of road funds to the general fund of the state. Then they ordered a $5,000,000 bond issue and increased the gasoline tax from 6 to 7 cents, the extra cent to be used to retire the bond issue.

"And so the people who use the roads are taxed with a *special tax* to pay state debts which have no connection with highway transportation."—F. E. Everett in *American Highways.*

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"The strangest use of gasoline tax money occurs in an eastern state. Last year that state paid out $75,000 of gasoline tax money to the State Department of Conservation for oyster propagation. More than one-fourth of the gasoline money collected by a southern state in 1930, $3,780,000, was diverted to the erection of school buildings and the support of schools. In another state in the South $2,200,000 of gasoline tax money went for the same purpose. In another state it is possible to levy the gasoline tax only under the constitutional provision of occupational taxes, which means that one-fourth of the gas tax money must be paid for schools. Consequently around $7,000,000 of gasoline tax money collected from motorists in that state yearly goes into state school funds."—*American Highways.*

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"The French have a saying that the ideal tax system is one that produces the most feathers with the least squawk. The gas tax has fairly met that ideal. But too many feathers will not only produce a big squawk but may kill the goose."—*Stockton* (Calif.) *Independent.*

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"The *News* has always protested against the use of gasoline tax money for other purposes than those for which it was originally levied."—*Santa Cruz* (Calif.) *News.*

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"When gasoline used in automobiles was first seized upon as a subject of taxation there was universal approval. All profit by the construction of good highways. But here in Virginia greedy eyes were turned upon this source of revenue, and it is now suggested that a part be diverted to other purposes. There is little doubt that when the Virginia general assembly meets efforts will be made to put that suggestion into effect. Everybody interested in good roads should be on guard ready to fight this proposal to the limit."—*Lynchburg* (Va.) *News.*

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"The theory that a portion of the gas tax or license fees should be diverted to the general state fund to replace the shrinkage in railroad taxes because of the competition of the motor car and truck is fallacious and will not bear a thorough analysis.

"The transportation of materials for the construction of the motor vehicle, the vehicle, supplies and accessories, along with the thousands of tons of cement, sand, stone, gravel, asphalt and other materials used in road construction and maintenance of highways, has brought to the railroads much more revenue than they have lost in passenger and freight business, absorbed by automobile and truck."—H. G. Shirley, state highway commissioner, in *Richmond* (Va.) *News-Leader.*

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"The unfairness of diverting a 'one-purpose tax,' levied upon a special group of taxpayers, from the specific service to which it was dedicated and by which alone the special levy was justified, is everywhere admitted. Yet, nevertheless, the diversions will be continued on a growing scale, we suspect —unless and until the motorists collectively and individually put up a much stronger and more resolute fight against the manifest injustice than they have done thus far."—*New Orleans Times-Picayune.*

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"Certainly it was not the intent of the gas-tax proponents that these annual incomes should pay every conceivable expense of government or farm relief or other entirely foreign item advanced by the many agencies seeking to obtain substitutes for direct property taxation. Gas taxes were voted for roads, and only for roads should they be spent."—*Western Construction News.*

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"Discussing the defeat of the 1-cent gasoline tax proposed in Ouachita parish as a means of raising an employment fund, the *New Orleans State* suggests that general opposition to increased taxes and resentment of automobile owners against being made 'tax goats' were the chief contributing causes."—*Shreveport* (La.) *Times.*

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"Many states are diverting this gasoline tax to other purposes than roads. This is wrong in theory and principle and should not be done. The gasoline tax is in reality a toll paid for good roads and every cent of money raised by that method should be used for bettering the highway system."—*Essex Record,* Essex Jt., Vt.

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"Another recent tendency, more dismaying to drivers, is diverting gas tax money to other purposes than highway work. When a new tax brings in millions a year—as Ohio's cigarette tax is expected to do—legislatures evidently cannot resist the temptation to increase the rates and use the revenue for general expenses."—*Cleveland* (Ohio) *News.*

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"The temptation to dip into highway funds for the benefit of other departments increases as those departments face financial complications. It is particularly necessary this year to guard against such diversion of gasoline taxes, motor vehicle fees and other highway revenues, as Thomas H. MacDonold, Chief of the Federal Bureau of Public Roads, warned the highway officials of the North Atlantic States in their convention at Atlantic City. Governor Moore's proposal to use $16,500,000 from New Jersey highway funds for municipal tax relief is only one of the many determined efforts of this nature.

"These revenues are paid by the users of the public highway and should be expended for no other purpose than road construction and maintenance. If these revenues exceed the requirements of any state, tax relief should be provided as the source of reducing the highway fees."—*Philadelphia Public Ledger.*

Federal Trade Commission Reports on "Basing-Point Formula and Cement Prices"

Very Much Against System of Making Delivered Prices with Absorption of Freight Rates

THE FEDERAL TRADE COMMISSION on March 26 made public its first report on its investigation of price bases, which is an inquiry into the methods of basing prices with respect to location. The purpose is to give help toward a solution of the problem of a greater economy in distribution.

While some data obtained from studies of the cement industry are used in the price bases report, the commission also is conducting, under a senate resolution which relates to the cement industry, a separate inquiry into alleged violations of the antitrust acts, and it is expected a report soon will be made on that subject.

The price bases inquiry was undertaken on the commission's initiative. In its resolution authorizing the study the commission recognized as "one of the chief problems of the day," the "economical distribution of commodities." The commission believed that the method of determining the prices (or the total cost to the purchaser) of commodities sold in the same or in different localities was "an important factor in a sound system of distribution," and it was aware of "various systems and theories on which such prices are made and marked differences of opinion as to their expediency and fairness."

The commission further observed that "some distributors are employing the policy of national distribution with prices, particularly in different consuming territories, that make no allowance for difference in transportation costs, while others allege that there should be a delimitation of markets having respect to transportation expense."

It was resolved that the commission's chief economist "inquire into and report upon (1) the factory base method, the basing point method and the delivered price method of quoting and charging prices (including their respective variations) together with any other method of differentiating prices with respect to location, (2) the causes for the adoption of the several methods employed and the purposes intended to be served by them, (3) their actual and potential effects upon prices and competitive conditions and (4) any constructive measures which might be employed to promote greater efficiency, economy or fairness in the methods of quoting or charging prices."

Prior to passage of the price bases resolution, the commission had experience in matters of price basing in the prosecution of its well known "Pittsburgh plus" case. The large steel corporation involved was ordered to cease and desist from its "Pittsburgh plus" arrangement in quoting prices. This case is an illustration of the basing-point method. A Pittsburgh mill could sell its products to fabricators and manufacturers in the Pittsburgh district at factory prices, but the same class of customers outside that district was charged, in addition to the Pittsburgh price at the factory, the freight charges from Pittsburgh to the outside point. But fabricators or manufacturers situated in Chicago, who bought products from the same steel corporation's Chicago factory, had to pay just the same price—that is, the Pittsburgh factory price plus the freight from Pittsburgh to Chicago.

Editor's Note

VIEWED in the light of developments of the past few years one could hardly say the cement industry has been notoriously successful in its methods of doing business. At the same time, of course, one would be rash to say it had done any worse than many others.

The cement industry has had the advantage of some others, however, in that very complete statistical data have been and are available for its business control. Also, advantage or disadvantage, according to one's point of view, it has always had to do business under the spotlight of full publicity, because, we presume, it comes directly in contact with important public officials as customers.

A first reading of the summary of the Federal Trade Commission's report on price basing methods, herewith, may very readily arouse a feeling of antagonism in the industry as an unfair, one-sided presentation. Producers could say (and have said) much in favor of their price-basing system. Undoubtedly most of them believe it is the best answer to a complicated problem that it is possible to find.

We believe that the system of price competition in the cement industry described by the commission may very possibly be improved upon to the benefit of all concerned. In any event we believe the industry will accomplish a great deal more for itself if it will accept the commission's report as made in good faith, really to help it out of some of its difficulties; in other words, in a cooperative spirit rather than in an antagonistic one.—The Editor.

The present report of the commission is being submitted to congress for its use in considering problems of distribution. The letter of submittal, containing a summary of the report, is presented in full text as follows:

On July 27, 1927, the Federal Trade Commission directed an inquiry into the methods of basing prices with respect to location as a step toward the solution of the problem of greater economy in distribution. These methods include the selling on the bases of (1) shipping-point prices; (2) uniform delivered prices, either country-wide or by zones; and (3) delivered prices made under what is known as a basing-point system, such as was used by the steel industry prior to the commission's cease-and-desist order, and which is now used by it in a modified form. This inquiry is intended to discover the causes for the adoption of these various methods, and their relation, if any, to the matter of competition, differences in prices, price levels, and cross freighting or other needless costs. The present report, the first of the inquiry, deals chiefly with the multiple basing-point system as employed by the cement industry.

Prices may be classified with respect to the place of transfer and the incidence of transportation cost into shipping-point and delivery-point, or delivered, prices. The former are those for commodities whose transfer of title usually occurs at the shipping point and whose transportation cost from point of origin to any point desired by the buyer is borne by him separately from the price. The latter are those for commodities whose transfer of title usually (sometimes modified by custom or contract) occurs at the delivery point and whose transportation cost from shipping point to a specified destination is paid by the seller and, to the extent borne by the buyer, included as a part of the delivered price.

Basing-point delivered prices are the sum of a recognized established price for some point called the basing point and specified freight charges from such point to the several destinations for which these prices are made, this formula controlling the price, regardless of actual origin of shipments or of actual freight incurred. A single basing point may be used by an industry, or there

may be two or more. Under the multiple basing-point formula, the delivered price for any destination is that sum of price at some basing point and freight therefrom, whichever is lowest, all basing points considered.

A variant of the basing-point price is the zone price. This is a delivered price uniform for all destinations in each of a series of specified areas, or zones, and is the sum of a price for basing point, or area, and some sort of an average of freight rates therefrom to destinations in the zone. Closely akin to the zone price is the single uniform delivered price for the country as a whole, sometimes called the postage-stamp price.

General Survey of Industry

In a country-wide survey of the price-basing methods used by manufacturers, it was found that of the more than 3500 reporting firms, including manufacturers in practically all industries, 44% sell on an exclusively shipping-point price basis, 18% on an exclusively delivered price basis and 38% on both bases.

Eight out of 15 industry-groups each shows more than 50% of the reporting firms in the exclusively shipping-point class, while no industry-group has 50% in the exclusively delivered price class. Transportation equipment shows the highest percentage of plants on an exclusively shipping-point basis.

Of all firms reporting shipping-point prices, 15% make all or a part of these prices with partial freight allowances. Such allowances are usually for the purpose of equalizing freight with the competitor freightwise nearest the buyer's destination. The industry-group which leads in this practice is iron and steel and products (excluding machinery).

Of firms reporting delivered prices, those whose prices are uniform for all destinations show the largest percentage, those whose prices are uniform for zones coming next and finally those selling on basing-point prices. Of the several industry-groups, rubber products show the highest percentage of firms with delivered prices uniform for all destinations; chemicals and allied products, the highest percentage of firms with delivered prices uniform for zones; and iron and steel and products (excluding machinery) the highest percentage of firms with delivered prices made by use of a basing point. In a proceeding before this commission the single basing-point system of that industry, as employed by the United States Steel Corp., was in issue and was concluded by an uncontested order of the commission requiring the respondent to cease and desist therefrom.

Basing-Point System in Cement

The cement industry affords a striking illustration of the multiple basing-point method of merchandising. It is an industry that supplies one of the principal materials in road-building, for which about one-third of the entire cement output is used, and it is also one of the three or four important industries for structural materials, about one-fourth of the cement output being so used. Its growth has been rapid, the production of cement having more than trebled from 1908 to 1928, the latter being its peak production year.

Although cement mills are found in 32 out of 48 states, yet shipping distances are great. The weighted average freight rate paid on shipped cement in 1927-1928 was 38c. per bbl., or about 22% of the average mill price. Moreover, for large numbers of shipments by many different mills widely scattered this percentage, representing the ratio of freight rate to mill price, ranges upwards to above 50%. It is obvious that the ratio of freight rate to mill cost is considerably higher than the ratio to mill price.

Cement manufacturers sell their cement on a multiple basing-point system, whereby a uniform delivered price for each point of delivery can be calculated with mathematical precision, provided only that base prices and rail freight rates are known. Freight rates are compiled cooperatively by the cement industry and furnished to the manufacturers. This factor is therefore definitely and uniformly applied. Base prices are easily ascertained and generally known. When any mill has a mill price sufficiently low that the sum of this price and freight to any single delivery point makes a delivered price lower than that of any other mill similarly calculated, such a mill is a basing-point mill and such a mill price is a base price. Some 85 or more mills in the industry were located at basing points in the middle of the year 1930. Non-basing mills, of which there were about 80 at that time, sell cement only on the delivered prices made by some basing-point mill or mills.

Divergence of Mill Net Prices

The most significant aspect of the basing-point system is found in the divergent mill net prices which usually prevail under that system and obtain in a marked degree in the cement industry. Widely different mill net prices realized for any one mill at any one time upon substantial portions of the mill's sales are indicative of very imperfect price competition, because competition in price implies the frequent shading of a competitor's price, when costs permit, as an inducement of the seller to divert buyers from that competitor's product to his own. And the seller's costs presumably do permit it, if he is making to one group of buyers lower mill net prices than to some group or groups of buyers elsewhere in order to secure additional volume. Under active price competition the higher net prices tend to be shaded and sales to the lowest net price group discontinued, if necessary, until net prices generally are substantially equal.

Out of sales of 16,000,000 bbl. made by 51 cement manufacturers to dealers in 21 cities, 1927 to 1929, only 35% were made at the respective mill's maximum net prices prevailing at the time of sale. On 65% of the sales there were deviations from the maximum mill nets ranging up to nearly $1 per bbl. Thirty-four per cent. of the sales show deviations of 1c. to 20c. from the maximum net, 21% deviations of 21c. to 50c. and 10% of 51c. and upward.

Similar results are shown for 3,000,000 bbl. of cement sold by 14 manufacturers to Wisconsin dealers in 1927; for 7713 bid delivered prices for 9,000,000 bbl. to five state highway commissions in 1929, and for the total sales of six mills located in four states covering 4,000,000 bbl. to widely scattered destinations.

Uniformity of Delivered Prices

Two other tests may be applied to basing-point prices in the cement industry to determine their competitive character, that of price uniformity and that of price constancy or inflexibility.

Uniformity of delivered prices made by two or more sellers for any one point of delivery, taken in connection with a great divergence of mill net realizations and a high degree of constancy of prices over considerable periods of time, becomes a measure of the perfection with which the basing-point formula is working, instead of signifying competition, since only as the formula is violated will there be diversity of delivered prices at a particular point.

Examination of manufacturers' invoices to dealers in 21 cities covering 22,000,000 bbl. of cement in 1927, 1928 and 1929 shows 100% uniformity in delivered prices to dealers in 13 cities and in three other cities practically complete uniformity, from 5 to 17 manufacturers being involved in the case of each city. No city shows less than 81% uniformity. One hundred per cent. price uniformity means that as regards the invoices examined, all producers sold to all dealers in a given city at exactly one and the same price, the price obtained by applying the formula, viz., the lowest combination of base price and freight rate.

While 94% of the total of these sales were made at uniform delivered prices, only 35% were made at maximum mill net realizations. That is, while there is a high degree of uniformity of delivered prices for two or more manufacturers on sales to one or more buyers at the same point, the degree of uniformity of mill net realizations by a given manufacturer at a given time on sales to buyers freightwise differently located is relatively very low. That the two conditions should prevail for the same sales is highly indicative of a low state of price competition.

Similar results appear on sales of 2,900,000 bbl. of cement made in 1927 to Wisconsin dealers and on nearly 8000 bid prices to five state highway commissions in 1929.

Inflexibility of Price

A third test that may be applied to basing-point prices to determine their competitive character is that of their flexibility or varia-

bility through a period of time, indicating the degree of their sensitiveness to changes in the demand and supply of the commodities to which they apply. Where the various producers sell a substantially similar product in an industry not under public control, and the wholesale price of its product is unusually inflexible for a considerable period, and an examination of demand-and-supply conditions for that period shows no corresponding constancy, there is a reasonable basis for the belief, due allowance being made for the influence of inertia and custom in price making, that either the supply or the price of the product is not determined by normal competitive processes.

In respect to the delivered prices of cement during the past few years, the formula price was maintained for Baltimore throughout 1927. Washington, Wilmington, Philadelphia and New York each had but one change in that year, which occurred in January; Chicago and Minneapolis over a period of 32 months, in 1927 to 1929, each had but two changes; Cleveland in the same period, four changes; Indianapolis, four changes in 33 months; St. Louis and Madison, Wis., each three changes in 33 months; and Birmingham, three changes in 24 months.

In respect to basing-mill prices, attention is called to four great producing centers. The Lehigh Valley mills, some 22 in all, maintained their prices on a dead level from January, 1927, to November, 1930, except in the period August to November, 1929. Prices of the Hudson Valley mills followed the same course, except that from November, 1929, to November, 1930, they were 10c. higher than for the period prior to August, 1929. The price curve for the Buffington (Ind.) mills was very similar, except that during the last year of the period the price was 10c. lower than for the period prior to August, 1929. The Birmingham mills show a price curve declining rather consistently from January, 1927, to August, 1929, but rising in November, 1929, by 50c. per bbl. in a single jump.

Factors Contributing to Imperfect Competition

There are several obvious conditions in the cement industry which, though they may not be the primary cause of its imperfect price competition, yet are clearly contributing factors thereto. If delivered prices under a basing-point system are unduly high, they begin in high prices at basing-points of which there are comparatively few. One of these conditions, therefore, may be found in the effective use the industry makes of leadership. All cement mills, as regards price-making, fall into two classes: Those that assume price leadership and those that do not. A mill that establishes a price at its mill point and delivered prices for other points lower than the base price of any other mill together with freight therefrom to those points, respectively, makes of itself a basing-point and assumes price leadership at all such points. Outside such points it follows the leadership of other basing mills as regards prices. The non-basing mill assumes no price leadership but adopts the delivered prices of others as it finds them. This may also be true of a mill located at a basing point where there are two or more mills. Many mills are so located. Such a price policy has directly only a negative effect upon the level of prices and in that sense denotes an absence of price competition on the part of these mills.

Six companies (now reduced by merger to five) operating 46 plants east of the Rocky Mountains produced, in 1927, 47% of the total output of that part of the United States. Another 30% was produced by mills at non-basing points, and 18% by mills at or near the basing-point mills of these six companies. This accounts for all but 5% of the entire output east of the Rocky Mountains.

Such concentration gives a favorable basis for mill price leadership, made effective in part by the basing-point formula which, though not of itself the primary cause of non-competitive mill prices, becomes a powerful instrument in their maintenance. Under a relatively inflexible mill-price policy, shipping long distances and absorbing freight becomes a seeming necessity in order to expand volume of output, the urge of every producer under the spur of idle capacity. Under relatively high mill prices, this freight absorption becomes possible without breaking the mill-price structure or incurring loss. The formula acts as a protection to the price structure, for its strict observance requires that the price at no point of delivery be reduced by a given mill below the then lowest combination of base price and freight, except as that mill lowers its own mill price sufficiently to make the new delivered price. Since such a reduction under the formual automatically lowers the price and realization in the mill's most profitable territory, observance of the formula tends to preserve not only the base price governing the mill's maximum net price territory, but all base prices effective in its under-maximum net price territory.

When the basing-point formula is working 100% there is no competition in price at the point of delivery except by the change of some basing-point price. However, there is an occasional recalcitrant producer in the cement industry who violates the formula either frequently or occasionally. Cement brands being practically alike, and producers' distributing services highly standardized, a slightly reduced price gets the business. Usually this is effected by the mill's discontinuing the formula prices in shipments to some delivery point, or points, without such reduction in its mill price as would make the net on these shipments its maximum mill net. This practice, when other mills hold to the formula price, gives the cut-price mill a higher average mill net than would going farther afield with high freight and selling costs, and at the same time enables it to run at more nearly full capacity with further advantages in cost.

Among the several methods used against such an offender the most drastic is that of compelling him to reduce his mill net price by putting in the equivalent of a base price in his highest priced territory, thus reducing the net price previously realized by him. By this method such a mill may have its average mill net reduced below cost.

Some of the companies disposed to price independence have been eliminated by acquisition, either by the highway of "benevolent assimilation" or over the rough road of bankruptcy. Several instances of this character have come to the attention of the commission.

The merger movement in the cement industry has contributed to more effective leadership, not only by eliminating in some instances a specific company disposed to price independence, but also by reducing the number of minds to synchronize. Several mergers have been effected in recent years, the most notable one being that of the Universal Portland Cement Co. and the Atlas Portland Cement Co. of January, 1930.

Yet another condition contributing to imperfect competition is in the activities of the industry, operating chiefly through its various associations, in collecting and disseminating operating information, in compiling and distributing cement freight rates and in checking up violations of the industry's code of commercial practices.

The use of a uniform freight rate by the industry is essential to the finding of a uniform delivered price under the basing-point formula. To accomplish complete uniformity of rate, freight rate books are compiled by the industry. Since freight rates are quoted in railroad tariffs in cents per hundred pounds, but delivered prices are quoted by the manufacturer in cents per barrel, it is necessary, before using the rate for price-making purposes, that it be converted to a barrel equivalent. This computation usually results in fractional cents which, in order to have a price in even cents, must be fractionally increased or decreased. In order that like results in delivered price be arrived at in the use of the freight rate books, a conversion table has been published in the fore part of each book, the use of which makes it certain that, if the formula is followed, the prices of all producers at any given point will be identical.

It is this conversion table that makes the freight rate book something more than a book of freight rates for the calculation of freight bills. Its admitted purpose is "to permit the manufacturers to make a ready calculation of the destination prices figured in barrels." The per barrel rate shown by this conversion table is seldom an actual freight rate and freight bills acceptable to the railroads could not be computed by its use. If, as asserted by cement producers, the difference of 1c. per barrel may make

the difference of a sale, it is seen how essential the conversion table is in arriving at uniform prices where fractional cents must be dealt with.

Price Differences

Differences of mill net prices are marked as those in the cement industry not only are an indication of imperfect competition, but are themselves found to affect buyers, and in some instances competitors, unequally. The mill whose base price and freight rate made the Chicago delivered price in 1927 is located near Chicago. This mill's output for that year was more than 9,000,000 bbl., while Chicago's consumption was about 3,800,000 bbl. Less than one-third of this consumption was supplied by this mill, which at the same time shipped large quantities long distances on which it realized a mill net far below that realized on its Chicago shipments. Its average mill net realization for that year on all shipments, including those to Chicago, was 22½c. per bbl. below its net on Chicago shipments. Had mills generally been following a system of selling fully competitive, this mill could have supplied Chicago's requirements for 22½c. per bbl. less than the city paid and still have realized the same average net it realized under the present system. This would have meant an estimated saving to the city for that year of more than $800,000, which represents the unnecessary transportation element in the Chicago delivered price.

The attempt has been made at times to restrict arbitrarily the application of a base price to a given territory, even though this resulted in a delivered price outside this territory higher than would have been made had the base price been permitted to control and in differences of net realization not directly occasioned by competition at the point for which the lower net was received. This occurred as between the Ironton (Ohio) and Birmingham basing points at each of which the same company operates a mill. Because of the low Ironton price relative to the Birmingham price, the Ironton base mill was making delivered prices in a territory to which the Ironton mill could less profitably ship than could the Birmingham mill—an indication that the ratios of base price to factory costs or other essential conditions were out of competitive harmony. In another case, it was found that a dual base price was maintained by one mill for some years, whereby one base price was made to apply to the state of Michigan and a higher base price outside the state.

Perhaps the most objectionable of all cases of price differentiation found in connection with the cement industry's use of the basing-point system is that resulting from one mill, or group of mills, setting the mill price of another mill, freightwise differently located, above which it may not go—objectionable not only because the aggressor mill makes lower mill net price to one group of buyers than to another which it itself initiates, but because the setting of a relatively low mill price for another mill reduces its own average net realization much less than that of the mill whose mill price is thus set. Such price differences were found both where the mill against which these tactics were being employed was a state-owned mill and where the mill was one showing marked independence in its price policy by frequent failure to observe strictly the formula system.

The outstanding case of this kind, coming to the attention of the commission, was that of the South Dakota state plant located at Rapid City. According to the statement of the chairman of the state cement commission, the state mill has had little choice in the naming or making of a mill base price, its competitors putting out quotations to the cement trade shortly after it started operation in 1926 which fixed its base price and which it felt forced to accept. Since then these quotations based on Rapid City have been changed from time to time, the changes originating with the state plant's competitors. In August, 1929, when cement prices were being reduced generally, the mill's competitors lowered the quotations based on Rapid City by 20c. In January, 1930, these competitors renewed those low quotations which were based on Rapid City, when at the same time they raised the quotations which were based on their own mills.

Cross Freighting

Substantial differences of mill net prices, both an evidence and a result of defective competition, not only affect buyers and competitors unequally, but furnish in the aggregate a measure of uneconomic production and transportation costs attendant upon the use of the multiple basing-point system. Included in such transportation costs is that of the cross-haul between two market areas of a standardized commodity for which the freight cost is relatively large. This and other phases of the basing-point system might be clarified by a study of costs. These costs have been submitted to the commission by the cement industry, but, at the time of completing this report, had not yet been analyzed and are reserved for a supplemental report, should this seem to be justified by the results of the analysis.

The cross-haul is generally recognized by the cement industry itself as an economic evil. Cement manufacturers who discussed the matter with representatives of the commission almost without exception admitted the prevalence of the practice in the cement industry and also its unsoundness, though not all seemed to recognize the causes of the practice or its implications.

An approximate measure of the uneconomic production and distribution cost imposed by a system of selling not fully competitive is found in a mill's freight absorptions, i.e., the excess of its average price at the mill for a given period over its weighted average mill realization, or net price, on all shipments for that period. On cement sales of 141,000,000 bbl. for 1927, representing 81% of the total shipments for that year, this excess amounted to an average of 24.3c per bbl. or a total of $34,000,000. Applying this per barrel rate to the entire shipments for 1927, the total would amount to about $42,000,000. Of the total production and selling cost, these freight absorptions are estimated to amount to an average of about 20%, widely deviating from this average, however, as regards individual mills or regions. This estimate represents the maximum amount that could be saved by eliminating cross-freighting.

The explanation of the uneconomic movement of commodities is commonly said to lie in the "hunger for tonnage." This explanation, however, ignores one significant circumstance attending the practice under the basing-point system, viz., the manufacturer does not seek to satisfy his hunger for tonnage through increase of sales by a lowering of delivered price to consumer so much as by an intensifying and widening of his market at the same consumer price, though this involves extra transportation cost and so a lower price yield to himself.

The habitual practice of the cross-hauling of a standardized commodity, like cement, appears to be due primarily to a rather rigid maintenance of mill prices at a relatively high level and only secondarily to "tonnage hunger," as often alleged. The high level of mill prices makes the cross-haul possible without absolute loss in total sales, and the rigidity of prices tends to prevent the expansion of sales in maximum net territory by mill price reduction. Under such conditions the mill seeks to satisfy hunger for large volume, intensified often by surplus capacity, by pushing out into less profitable territory in an effort to capture another mill's most profitable business. The result is a swapping of more for less profitable customers at a large net loss to the public in wasteful production and distribution costs.

The basing-point formula of selling assists in maintaining this rigidity of price at the mill, in that it prevents a mill in one market area from dumping its product into another market area at prices below the formula delivered prices of the latter without first reducing its own mill price.

Under Senate Resolution 448, 71st Congress, 3rd Session, which relates to the cement industry, alleged violations of the anti-trust acts are being examined by the commission, and it is expected that a report will be made upon this subject at an early date.

Stone in 1930

STATISTICS on stone in 1930 have been prepared and issued by the Bureau of Mines. The report includes all types of stone operations, with some information on world operations, as well as detailed information on the industry in the United States.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Aggregate Grading for Tamped Concrete Pipe

By George W. Gleeson*

VERY FEW definite recommendations appear in the literature as regards the grading of aggregates for the fabrication of mechanically compacted concrete pipe. While such a grading is admitted to be highly desirable,[1] there seems to be no recorded researches available to guide pipe manufacturers. This fact is perhaps the result of reticence on the part of the pipe producers, who regard the results obtained from practical experience as trade secrets, or it may be due to the fact that no comprehensive study has been made of the "dry mixes" or non-plastic type of concrete. Indeed, very little data are present in the literature on any phase of pipe manufacture, and while the following does not pretend to give any distinctive information, it presents for criticism and discussion a seldom considered condition that exists in the concrete pipe field.

Concrete pipe is now an established staple in the construction field and has experienced a continual progress through recent years, evolving from a rather non-uniform, hand-made article to a uniform, machine-compacted product. Much credit for the improvement of the product should be given the practice of including larger size aggregates in the pipe mixes. However, this practice may have been carried too far. Many products plants have loaded their mixes to the maximum possible extent with large size aggregate. The results are only too evident, even by casual inspection. Segregation and spotty pipe, failure to pass percolation tests, incomplete aggregate coverage, and harshness of mix have resulted. Even though a somewhat higher strength, lower absorption and slight gain in production may result from the heavily loaded mix, the gain does not compensate for the loss in water-tightness or appearance. To the end that the above-described tendency may be modified in a measure, a grading is recommended that appears practical in all respects.

The harshness of mix, upon which the possible compaction depends, is regulated to a very large measure in dry mixes by the fineness of the aggregate. This is true because of the inherent workability of the finer material as well as the larger amount of mixing water that can satisfactorily be incorporated in the finer mix. The advantages of the increased water content are quite evident from test results.[2] The resistance to compaction is, of course, the friction between individual aggregate particles and against the form wall, and the arch action that is developed by the thin section into which the concrete is forced, this action being exaggerated by the presence of reinforcing. As the section or wall thickness varies directly with the pipe size, it is obvious that an increase in the coarseness of aggregate can accompany an increase in pipe diameter, it being necessary to use a much finer mix to obtain satisfactory compaction in the smaller pipe sizes.

As pointed out by F. O. Anderegg,[3] there exists in all concrete a boundary condition that requires at such locations a larger proportion of fines to close the void space and promote density than is considered necessary in the main body of the concrete. This condition is very much exaggerated in the fabrication of pipe, since the ratio of surface to volume is exceedingly high. Since the resistance to compaction depends upon the surface, it might be expected that the ratio of surface area to volume would be an index of proper aggregate size.

Referring to Fig. 1, the surface area-volume ratios have been computed for different commercial pipe sizes and plotted against the pipe diameter. In the smaller pipe sizes the ratio of surface area to volume is well over two for unit pipe length and decreases as the pipe diameter increases, until for the 30-in. pipe the surface area is about one-half the concrete volume. It may be considered that the resistance to placing the concrete in the form is proportional to this ratio as far as water-tightness is concerned. Consequently, trouble is experienced from percolation in the smaller pipe sizes, although the mix used may actually be more plastic or workable than that used for larger pipe.

Using the fineness modulus as a measure of grading of the aggregate, the fineness of the grading being proportional to the modulus, and knowing the general fact that sand or fine aggregate adds to the workability of the mix, it is only logical to expect some direct relationship to exist between the fineness modulus and the ratio of surface to volume. This ratio should be in such a direction that a lower fineness modulus cor-

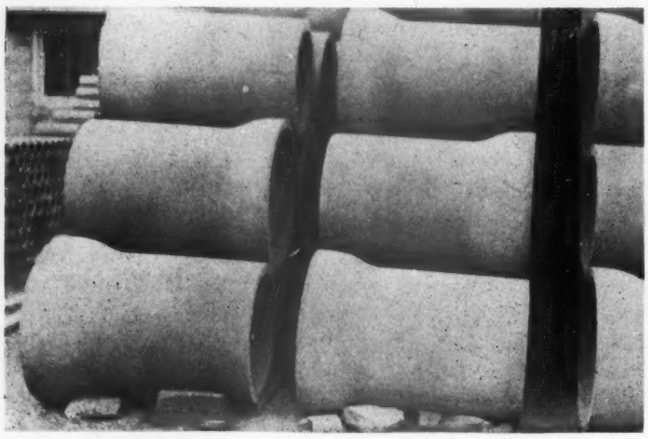


Fig. 2. Showing pipe smoothness resulting from proper grading of aggregates

*Testing engineer, Tuerck MacKenzie Co., Portland, Ore., and instructor, Oregon State College.

[1] M. W. Loving, *Journal Amer. Concrete Inst.*, May, 1930.

[2] *Concrete Products*, December, 1929.

[3] *Journal Ind. and Eng. Chem.*, September, 1931.

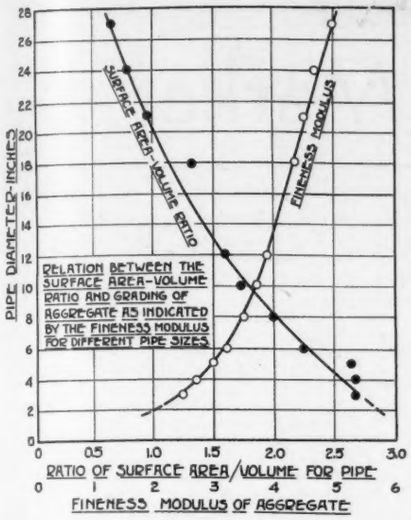

PIPE DIAMETER-INCHES
SURFACE AREA-VOLUME RATIO
FINENESS MODULUS
RELATION BETWEEN THE SURFACE AREA-VOLUME RATIO AND GRADING OF AGGREGATE AS INDICATED BY THE FINENESS MODULUS FOR DIFFERENT PIPE SIZES
RATIO OF SURFACE AREA/VOLUME FOR PIPE
FINENESS MODULUS OF AGGREGATE

Fig. 1. Relation between surface area, volume and recommended fineness modulus for different sizes of pipe

responds to a higher surface-volume ratio. Such a relation is more useful in terms of pipe diameters, and Fig. 1 also includes the fineness modulus as recommended for different pipe diameters by plotting the modulus against the diameter. The values recommended are partly the results of experimental tests and partly the results of observations of different mixes in a number of plants. The values check fairly well with those recommended by Walker[4] some years ago.

The values in Fig. 1 may be calculated or extrapolated for any pipe diameter with sufficient accuracy for the purpose, and while not necessarily absolute or rigid, will provide a somewhat simplified means of plant control to assure complete coverage, impermeability and general good results when correlated with the intermittent grading. The apparatus required for checking is simply that necessary for a sieve analysis and the data obtained afford a high return for the effort expended. The calculation of the fineness modulus is greatly simplified by the use of the monograph presented in bulletin No. 1 of the Portland Cement Association. The ease of effecting a mix is also enhanced by

[4]*Proc. Amer. Concrete Inst.*, 1925.
[5]*Concrete*, July, 1929.

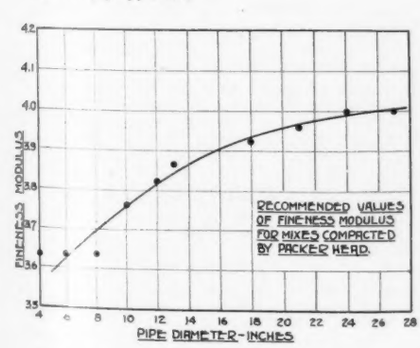


Fig. 3. Fineness modulus recommended for different sizes of pipe

the use of the intermittent as opposed to the continuous type of grading, since only two aggregates are used, these differing widely in size. A combination of the recommended fineness modulus (to prevent too fine or too coarse a mix) and the intermittent system (to promote workability and low aggregate void space) permits the passing with ease of all three pipe tests, namely, strength, absorption, and percolation. Fig. 2 indicates the smooth, spot-free surface of pipe fabricated in accordance with the above.

Bespalow[5] has offered recommendations relative to the fineness of grading for mixes compacted by the packer head process. The fineness is necessarily greater for this type of compaction due to mechanical conditions. The writer takes the liberty to again present these data in the form of Fig. 3.

In lieu of more exact information, the preceding discussion in a measure presents values and limits for plant approximation. The mathematical side of the question has been evaded for the more practical correlation of pipe diameter against the recommended grading. It is hoped that criticism or confirmation of the values will be forthcoming from experience in other locations.

Influence of Autoclave Conditions on Strength of Sand-Lime Bricks

THE EFFECT of time and pressure of autoclaving on the wet and dry strengths and free lime contents of sand-lime bricks is shown in an article by G. E. Bessey and F. M. Lea in a recent article in the *Journal of the Society of Chemical Industry*, London, England.

A standard mix of 10% hydrated lime, 27% clean fine sand (120-mesh) and 63% Leighton Buzzard sand (20-30-mesh) by weight, was used, approximating the mix commonly used in the manufacture of sand-lime bricks. Specimens 1.5 in. in diameter and 2.1 in. long were used. Free lime determinations by the glycerol method were made on the crushed cylinders.

Preliminary tests to determine the effect of water content on compressive strength showed some variations, but resulted in a water content of 5.34% being used for the main tests. In the main tests the specimens were autoclaved for 7 hours at 100 deg. C. (14.7-lb. pressure), 130 deg. (39.2-lb. pressure), 160 deg. (89.6-lb. pressure), 183.5 deg. 157.4-lb. pressure) and 195 deg. (202.6-lb. pressure) and for 4, 7, 16, 24 and 30 hours at 183.5 deg. C. (157.4-lb. pressure).

The results showed an increase in strength beyond the point at which all the lime is combined, indicating that the strength of the bonding material, hydrated calcium monosilicate, is increased by further autoclaving or increased steam pressure after its formation. Changes in the proportion and quality of lime and amount of water used, or variations in the sand, did not result in any appreciable increase in strength at pressures above 160 lb. per sq. in. for a constant period of autoclaving. Varying the mix changed the time required for maximum strength and also affected the wet-dry strength ratio.

While the conditions were not the same as in commercial practice where the autoclaving varies from 8-12 hours at 120 lb. to 4-6 hours at 200 lbs., the results should be helpful as a guide in determining the best time and pressure to use.

Projects Under A. S. A. Procedure

A REVIEW of civil engineering projects under American Standards Association procedure is given in the March issue of the *ASA Bulletin*.

This review briefly describes the origin, progress and present status of the several projects now under consideration, the following of which are of interest to the rock products industry: A1a—Standard Specifications for Portland Cement; A1b—1931—Standard Methods for Testing Cement; A2—1926—Fire Tests of Building Construction and Materials; A6—1930—Specifications for Drain Tile; A19—1923—Method of Test for Voids in Fine Aggregate for Concrete; A26—1930—Methods of Sampling Stone, Slag, Gravel, Sand and Stone Block for Use as Highway Materials; A27—1924—Method of Test for Apparent Specific Gravity of Coarse Aggregates; A31—1924—Specifications for Materials for Cement Grout Filler for Brick and Stone Block Pavements; A37—Methods of Testing Road and Paving Materials; A41—Recommended Practice for Brick Masonry; A42—Specifications for Plastering; A44—Method of Test for Organic Impurities in Sands for Concrete; and A45—Method of Test for Sieve Analysis of Aggregates for Concrete.

Municipal Quarry Defies Law

THE VIRGINIA General Assembly has forced Danville to bootlegging under municipal auspices, states the *Danville* (Va.) *Bee*.

The municipal bootlegging plant is the city rock quarry which under existing laws is not sanctioned. Despite this Danville intends to keep on operating the quarry until stopped by injunction.

Some years ago Danville was forced to suspend operating the municipal rock quarry because of an injunction.

After two years the injunction died a natural death and the city started up the rock quarry again and furnished itself stone. It has also sold some stone on occasion to nearby contractors.

Issues List of Publications

A LIST of publications of the U. S. Bureau of Mines, by subject and author, has been issued by it. The list includes publications issued from 1910 to 1932.

The Rock Products Market

Wholesale Prices of Aggregates

(F.O.B. Plant or City Designated)

	Crushed stone		Sand	Gravel,	Slag	
	Screenings, ¼ in. down	½ in. and less to 2½ in	¼ in. and less	½ in. and less to 2 in.	Screenings, ¼ in. down	Crushed, ½ in. and less to 3 in. and larger
Prices given are for crushed limestone per ton, unless otherwise stated						
EASTERN:						
Albany, N. Y. (u)			.90*	1.35*		
Alexander, N. Y.			.65d	.65d		
Boston, Mass. (g)			1.05	1.60		
Buffalo, N. Y.	1.25¶	1.25¶	1.00–1.10d	1.00–1.10d	1.50d	1.50–1.60d
Clarence, N. Y.			.60v	.60v		
Hillsville, Penn.	.85	1.25				
Montoursville, Penn.			.60	.40– .50		
New York City			1.00*	1.50*		
Philadelphia, Penn. (trap rock)	2.16–3.51	2.36	1.55	2.05		
Port Jefferson, N. Y.			.50*	1.25*		
Rochester, N. Y.			1.40	1.40		
Utica, N. Y.	.50–1.00	.75–1.25	.65– .75	.75–1.10		
Washington, D. C.			.85	1.30		
CENTRAL:						
Alton, Ill.	1.75					
Chicago, Ill.			1.00	1.00		
Davenport, Iowa	1.00	1.25				
Dubuque, Ia.	1.00					
Eau Claire, Wis.			.35– .40	.75– .85		
Greenbush, Mich.			.30– .40	.55– .70		
Grand Rapids, Mich.			.30– .40	.60– .70		
Hannibal, Mo.	1.00	1.25				
Indianapolis. Ind.			.40– .50	.50– .75		
McCook, Ill.	.60	.60				
Milwaukee, Wis.	1.34	1.44	.96w	1.11w		
Stone City, Iowa	.75	1.00				
St. Louis and Maplewood, Mo.	1.25	1.25				
St. Paul, Minn.	.75	1.25	.35	1.25		
Toledo, Ohio	1.16	1.66			1.10	1.20
Waukesha, Wis.	.90	.90	.40	.60		
SOUTHERN:						
Atlanta, Ga. (granite)	1.15	1.50				
Birmingham and Woodward, Ala.					.55‡	.90–1.25‡
Cartersville, Ga.	.75	.90				.80
Chico, Tex. (u)	.50	1.00–1.30				
(Trap rock)	2.25u	1.00–2.00u				
Columbia, S. C. (granite)	.50	1.40				
Ft. Spring, W. Va.	.35	1.00–1.25s				
Houston, Tex.			1.25*	1.95k		
Longdale, Va.	1.00	1.15			.75	1.10
Montgomery, Ala.			.25– .35	.50– .60		
New Braunfels, Tex.	.50	.90				
Roseland, La.			.50	.80		
WESTERN:						
Crushton, Calif. (San Gabriel Valley) (granite)	1.40	1.40	.80	1.40		
Denver, Colo. (h)			1.15*	1.75*		
Long Beach, Calif. (Granite and trap rock)	2.40	2.40	1.50	2.40		
Phoenix, Ariz. (n)			1.65	1.50		
Roscoe, Calif. (San Fernando Valley) (granite)	1.40	1.40	.80	1.40		
Salt Lake City, Utah			.60	.60		
San Francisco, Calif. (Bay points)			1.45	1.45		
Seattle, Wash.			1.25*	1.25*	1.25	1.25
Tulsa, Okla.	.70r	1.35r				

*Prices per cu. yd. ¶F.o.b. cars. †Less 10c per ton monthly settlements disc. ‡Prices less 5c disc. per ton for payment 15th following month. (a) Consumer prices subject to cash disc. of 10c per ton. (b) ½ in. to 1½ in. (c) 1½ in. and less. (d) F.o.b. trucks at plant. (e) Delivered in truck loads. (f) ¾ in. to 2½ in. (g) Delivered to job by truck, Boston. (h) Pea gravel, per cu .yd., 1.15. (k) Less 10c cash disc. (m) 2 in. and less. (n) Per cu. yd. in city limits. (p) Hard-head stone. (q) ¼ in. to 2½ in. (r) Less 15c per ton for cash 10 days. (s) 1.25 for ½-in. stone, 1.00 for other sizes. (t) Delivered on job. (u) F.o.b. plant. (v) F.o.b. cars or trucks. (w) Also 1.00–1.40 per cu. yd.

Masonry Cement

Packed in paper sacks. Prices, f.o.b. cities named, include cost of sacks.

	Per bag	Per bbl.
Chicago, Ill.	.46¾	1.87
Cincinnati, Ohio	.44	1.76
Cleveland, Ohio	.....	†1.62
Columbus, Ohio	.....	†1.61
Dayton, Ohio	.....	†1.62
Detroit, Mich.	.47¼	1.89
Indianapolis. Ind.	.43	1.72
Louisville, Ky.	.41	1.64
Memphis, Tenn.	.49¼	1.97
St. Louis. Mo.	.46¼	1.85
Toledo. Ohio	.....	†1.57

†Subject to cash discount of 10c per bbl. for payment within 15 days from date of invoice.

Mica

Prices given net, f.o.b. plant or shipping point.

Martinsville, Va.—Mica schist, per ton	16.00
Penland, N. C.—Mine scrap, per ton, 16.00; dry, ground, 25.00; roofing mica, per ton	18.00
Franklin, N. C.	
Mine scrap, per ton	18.00
Clean shop scrap, per ton	20.00
Ground mica, 20 mesh, 21.00; 40 mesh, 22.00; 60 mesh, 35.00; 100 mesh	42.00
Punch, per lb.	.05

Agricultural Limestone

(Crushed)

Alton, Ill.—90% thru 100 mesh	4.50
Branchton, Penn.—100% thru 20 mesh, 60% thru 100 mesh, 45% thru 200 mesh, all per ton	*4.50
Cartersville, Ga.—Pulverized limestone, per ton, 1.75; 90% thru 50 mesh, per ton	1.15
Chico, Tex.—Pulverized limestone, in 100-lb. bags, per cwt.	1.00
Colton, Calif.—Analysis, 95.97% $CaCO_3$; 1.31% $MgCO_3$ all thru 14 mesh down to powder	3.50
Davenport, Iowa — Analysis, 90-98% $CaCO_3$; 2% and less $MgCO_3$; 90% thru 4 mesh; bulk	1.00
Dolomite, Calif.—Analysis, 54% $CaCO_3$; 45% $MgCO_3$; 99% thru 10 mesh, per ton, 2.10; 49% thru 60 mesh, ¼-in. to dust, per ton	1.70
Dubuque, Ia.—Analysis, 64.04% $CaCO_3$; 29.54% $MgCO_3$; 90% thru 50 mesh, per ton	1.00
Fort Spring, W. Va.—Analysis, 90% $CaCO_3$; 3% $MgCO_3$; 50% thru 100 mesh, per ton, bulk, 1.25; in 80-lb. bags	2.75
Gibsonburg, Ohio—99% thru 10 mesh, 60% thru 100 mesh; in bags, per ton, 3.50; in bulk, per ton	2.50
Agricultural meal, 100% thru ¼-in. mesh screen, 25% thru 100 mesh screen, ton	1.00
Hillsville, Penn.—Pulverized limestone, per ton, bulk 2.50; in bags, 3.25; 70% thru 100 mesh, bulk, per ton, 2.75; in sacks, per ton	3.50
Knoxville, Tenn.—90% thru 100 mesh; in bulk, 2.00; in bags	3.00
Lannon, Wis. 50% thru 100 mesh	1.50
Marlbrook, Va.—Analysis, 96% $CaCO_3$, precipitated, bulk, per ton, 1.90; in burlap bags	3.00
McCook, Ill.—Analysis, 55% $CaCO_3$; 45% $MgCO_3$, 90% thru 50 mesh, 50% thru 50 mesh, 90% thru 100 mesh, 50% thru 100 mesh, all per ton	.60
Middlebury, Vt.—Analysis, 99.05% $CaCO_3$; 90% thru 50 mesh	4.25
Osborne, Penn.—100% thru 20 mesh; 60% thru 100 mesh, and 45% thru 200 mesh, per ton	†3.75
Stone City, Ia.—Analysis, 98% $CaCO_3$; 50% thru 50 mesh	.75
Waukesha, Wis.—90% thru 100 mesh, per ton, 4.00; 50% thru 100 mesh	2.10
West Rutland, Vt. — Analysis, 96% $CaCO_3$; 1% $MgCO_3$; 100% thru 40 mesh, per ton, in bulk, 2.50; in 80-lb. bags, per ton	3.75

*Less 50c commission.
†Less 25c discount.

Pulverized Limestone for Coal Operators

Davenport, Ia.—Analysis, 90-98% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 20 mesh, 50% thru 200 mesh; sacks, ton	6.00
Joliet, Ill.—Analysis, 48% $CaCO_3$; 42% $MgCO_3$; 90% thru 200 mesh (bags extra)	3.50
Waukesha, Wis.—90% thru 100 mesh	4.00

Roofing Slag

Prices given are per ton f.o.b. city named.

Bethlehem, Penn.	1.00–1.50‡
Buffalo, N. Y.	2.50†
Ensley and Birmingham, Ala.	2.05
Longdale, Va.	2.50
Toledo, Ohio	1.20¶
Woodward, Ala.	2.05*

*Less 5c ton disc. for pay. 15th following month.

†Price f.o.b. trucks at plant, subject to discount of 10c per ton for payment on or before the 15th of following month. ‡F.o.b. plant. ¶F.o.b. trucks, slag plant.

Portland Cement

	F.o.b. city named Per Bag	Per Bbl.	High Early Strength
Albuquerque, N. M.	.66	2.64	.....
Atlanta, Ga.	.....	1.90†	2.95¶
Birmingham, Ala,	.....	1.58†	2.63¶
Boston, Mass.	.44½	1.78†	2.52¶
Charleston, S. C.	.....	1.93†	2.98¶
Cheyenne, Wyo.	.52¼	2.09	.....
Chicago, Ill.	.....	1.35†	2.00¶
Cincinnati, Ohio	.....	1.42†	2.07¶
Cleveland, Ohio	.....	.....	2.08¶
Columbus, Ohio	.....	.....	2.06¶
Dallas, Tex.	.....	1.81	2.86¶
Dayton, Ohio	.....	.....	1.93¶
Denver, Colo.	.50	2.00	.....
Detroit, Mich.	.....	1.47†	2.12¶
Houston, Tex.	.....	2.03	3.08¶
Indianapolis, Ind.	.....	1.41†	2.06¶
Jackson, Miss.	.....	1.98†	3.03¶
Jacksonville, Fla.	.....	2.00†	3.05¶
Kansas City, Mo.	.....	1.94†	1.04¶
Los Angeles, Calif.	.57½	2.30	.....
Louisville, Ky.	.....	1.45†	2.10¶
Memphis, Tenn.	.....	1.77†	2.82¶
Milwaukee, Wis.	.....	1.45†	2.04¶
Montreal, Que.	.....	1.66§	.....
New Orleans, La.	.....	1.86†	2.96¶
New York, N. Y.	.37¼	1.49†	2.28¶
Oklahoma City, Okla.	.39½	1.58†	2.38¶
Omaha, Neb.	.35	1.40†	2.30¶
Portland, Ore.	.....	2.40‡	.....
Reno, Nev.	.....	2.80‡	.....
St. Louis, Mo.	.....	1.37†	2.02¶
San Francisco, Calif.	.....	2.05‡	.....
Savannah, Ga.	.....	1.93†	2.98¶
Seattle, Wash.	.....	2.30–2.55	2.80c
Tampa, Fla.	.....	2.00†	3.16¶
Toledo, Ohio	.....	.....	2.02¶
Topeka, Kan.	.....	2.15†	1.65¶
Tulsa, Okla.	.37½	1.50†	2.40¶
Mill prices f.o.b. in carload lots, without bags, to contractors.			
Hudson, N. Y.	.....	*1.21–¶1.36†	2.33¶
Lime & Oswego, Ore.	.....	2.40	.....
Limedale, Ind.	.....	1.10†	.....

NOTE: Unless otherwise noted, prices quoted are net prices, without charge for bags. Add 40c per bbl. for bags. †Includes 10c cash disc. ‡Subject to 2% discount payment 10th of month following invoice date. ¶"Incor" Perfected, prices per bbl. packed in paper sacks, subject to 10c discount 15 days. (c) Quick-hardening "Velo," packed in paper bags, 10c discount 10 days. §Sales tax included at 4%. *F.o.b. cars. ‖Trucks, mill.

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Brandon, Vt.—English pink, cream and coral pink (a)	¶12.50–‖14.50	¶12.50–‖14.50
Cardiff, Md. — Crushed green marble (a)	¶12.50–‖14.50	¶12.50–‖14.50
Cranberry Creek, N. Y.	.....	‖12.00
Los Angeles, Calif.—(a)		
White	¶11.00–‖13.50	¶11.00–‖13.50
Snowflake	.....	¶11.00–‖13.50
Golden, browns, grey, blues, blacks	¶16.00–‖18.50	¶16.00 ‖18.50
Dolomite, Calif. (Lone Pine)—(a)		
White	¶8.80– ‖8.80	¶8.80– ‖8.80
Snowflake	.....	¶8.80– ‖8.80
Golden, browns, grey, blues, blacks	¶13.80–‖13.80	¶13.80–‖13.80
Middlebrook, Mo.—Red	.....	20.00– 25.00
Middlebury, Vt.—White	.....	¶9.00–‖10.00a
Randville, Mich.—Crystalite, crushed white marble, bulk	4.50	4.50– 5.00
Tuckahoe, N. Y.	5.00	.....
Warren, N. H., per ton	.....	4.00– 5.00

¶C.L. ‖L.C.L. *Per 100-lb. (a) Including bags.

Art and Cast Stone Aggregates

Cardiff, Md.—Green marble fines in carloads; bulk, 7.50; in bags..... 10.00

Los Angeles, Calif.—Dolomite aggregates, all sizes and colors†..... ¶10.00 ‖12.50

Dolomite special cast stone, wet-cast aggregate, white, ¼-in. to dust a5.30

† 100-lb. sacks. ¶C.L. ‖L.C.L. (a) In open cars.

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Eau Claire, Wis.	.....	.60
Ohlton, Ohio	1.50	1.50

Glass Sand

(Silica sand is quoted washed, dried and screened)

Ohlton, Ohio	2.40
Ottawa, Ill. (Per ton, f.o.b. Ottawa)	1.25
Silica, Va.	2.25–2.75
South Vineland, N. J.	1.50

Chicken Grits

Chico, Tex.—(Limestone) packed in 100-lb. sacks, per cwt., f.o.b. plant	1.00
Cranberry Creek, N. Y.—Per ton	12.00
Davenport, Iowa—High calcium carbonate limestone, in bags, L.C.L., per ton	6.00
Gibsonburg, Ohio.—(Agstone)	5.00– 5.25
Hannibal, Mo.—(Limestone), sacked, per ton	12.00
Hartford, Conn.—Per ton	1.80
Indianapolis, Ind.—Per ton	.50
Los Angeles, Calif.—Marble grits, per ton, incl. sacks	10.00–12.50
Maplewood, Mo.—(Limestone), per ton	10.00
Middlebury, Vt.—Per ton (a)	10.00
New Braunfels, Tex. — (Limestone), per ton, in bulk	3.50
New York City—Per cu. yd.	1.00
Port Clinton, Ohio—(Gypsum), per ton	6.00
Port Jefferson, N. Y.—Per cu. yd.	.50
Salt Lake City, Utah—Per ton	.60
Utica, N. Y.—(Limestone), per ton	3.50
Warren, N. H.—(Aggregate)	7.80–11.00
Waukesha, Wis.—(Limestone), per ton	7.00

(a) F.o.b. Middlebury, Vt.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Chester, Vt.—Finely ground talc (carloads), Grade A—99-99½% thru 200 mesh, 7.50–8.00; Grade B, 97-98% thru 200 mesh. 1.00 per ton extra for 50-lb. paper bags; 166⅔-lb. burlap bags, 15c each; 200-lb. burlap bags, 18c each. Credit for return of burlap bags. Terms 1%, 10 days.	6.50– 7.00
Emeryville, N. Y.:	
Crude ground talc (200 mesh), bags	13.75
Crude ground talc (325 mesh), bags	14.75
Henry, Va.:	
Crude mine run, per ton	3.50– 4.00
Ground talc (150-200 mesh), bulk, 4.75; in bags	8.00
Joliet, Ill.:	
Ground talc, 200 mesh, in bags:	
California talc	30.00
Southern talc	20.00
Illinois talc	10.00
Natural Bridge, N. Y.:	
Ground talc (325 mesh), in 50-lb., 100-lb. and 200-lb. bags, per ton	10.00–20.00

Core and Foundry Sands

Silica sand quoted washed, dried, screened unless otherwise stated; lowest net prices per ton f.o.b. plant

City or shipping point	Molding: Fine	Molding: Coarse	Molding: Brass	Core	Furnace lining	Sand blast	Stone sawing
Albany, N. Y.	1.80	1.75	1.80	.....	.....	3.00	.....
Eau Claire, Wis.	.....	.....	.....	.....	.....	2.50	.....
Elco, Ill.	Amor. silica, 90-99½% thru 325 mesh,						$10.00
Montoursville, Penn.	.....	.....	.....	1.35a	.....	.....	.....
New Lexington, Ohio	2.00	1.25	.....	.....	.....	.....	.....
Ohlton, Ohio	1.50	1.50	.....	1.50	1.50	1.50	.....
Ottawa, Ill.	.....	.....	.....	.....	.....	3.50	.....
Silica, Va.—Ground silica thru 140 mesh, 8.00.							
South Vineland, N. J.—Dry washed silica, 2.00 per ton.							
Thebes, Ill.	.....	.....	2.00b	.....	.....	.....	.....

(a) To 1.50. (b) To 2.50 per ton, not washed, dried or screened.

Wholesale Prices of Slate

Lowest prices f.o.b. at producing point or nearest shipping point

Slate Flour

Pen Argyl, Penn.—Screened, 200 mesh, 6.00 per ton in paper bags

Slate Granules

Pen Argyl, Penn.—Color, blue-grey, per ton..... 6.00*

*Bags, 50c each, returnable for credit.

Roofing Slate

Prices per square—Standard thickness

City or shipping point	3/16-in.	¼-in.	5/16-in.	⅜-in.	¾-in.	1-in.
Bangor, Penn.—						
No. 1 Bangor	9.50	14.00	20.00	24.00	35.00	45.00
No. 1 Ribbon	7.50	10.00	15.00	20.00	30.00	40.00
Chapman Quarries, Penn.—						
Smooth texture	9.00–11.00	.....	.....	.....	.....	.....
Rugged	8.25– 9.00	a12.50	b18.00	b21.50	d25.00	e30.00
Pen Argyl, Penn.	.....	9.60	13.80	16.20	22.20	27.00

Albion blue-grey roofing slate, No. 1 clear, 5.50–6.75; mediums, 5.50–6.25; No. 1 ribbon, 5.50–6.25; punching, all sizes, 35c per square.
(a) To 15.00. (b) To 26.50. (d) To 32.00. (e) To 37.00.

Prices are for standard preferred sizes (standard 3/16-in slates), smaller sizes sell for lower prices. Prices other than 3/16-in. thickness include nail holes. Prices for punching nail holes, in standard thickness slates, vary from 50c to $1.25 per square.

ROCK PRODUCTS solicits volunteers to furnish accurate price quotations.

Lime Products

(Lowest carload prices per ton f.o.b. shipping point unless otherwise noted)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Bulk	Ground burnt lime, Bags	Lump lime In bulk	Lump lime In bbl.
EASTERN:								
Berkeley, R. I.	11.75	10.75	9.20	11.75	.....	16.50	.....	20.30
Buffalo, N. Y.	5.50	4.75	4.75	10.50	5.50	7.50	6.00	.....
Cedar Hollow, Devault, Rambo and Swedeland, Penn.	.....	8.00c	8.00c	8.00c	7.00	8.00	8.00	.....
Lime Ridge, Penn.	.....	.....	8.00	.....	6.00	7.00	4.50	.....
CENTRAL:								
Cold Springs, Ohio	.....	4.75	4.75	.....	.....	.....	5.00	.....
White Rock, Gibsonburg, Marblehead, Tiffin, Ohio, and Huntington, Ind.	5.50	4.75	4.75	10.50	5.00	7.00	5.00	.....
Delaware, Ohio	5.50	4.75	4.75	6.00	5.00	.....	5.00	.....
Sheboygan, Wis.	.....	10.50	.....	.....	.....	.....	8.50	19.00
Woodville, Ohio (x)	5.50	4.75	4.75	9.00	5.00	7.00	5.00	14.00
SOUTHERN:								
Cartersville, Ga.	.....	7.50	.....	.....	5.50	11.50	5.50	12.50
Eagle Mountain, Va.	.....	8.00	8.00	8.00	.....	8.00	6.50	.....
Keystone, Ala.	.....	7.50	6.50	7.50	.....	.....	6.50	13.75
Knoxville, Tenn.	.....	7.50	7.50	7.50	.....	.....	5.00	12.75
WESTERN:								
Kirtland, N. Mex.	.....	.....	.....	.....	.....	.....	12.50d	.....
Little Rock, Ark.	.....	12.10	.....	.....	10.10	.....	10.10	16.90
San Francisco, Cal.	(b)18.50	16.00	11.00	.....	.....	18.50	.....	.....
San Francisco, Calif.	17.00	15.00	11.70	14.00*	11.70	.....	11.70‡	.....

(a) In 100-lb. bags. (b) Woodburnt lime. (c) In 50-lb. paper. (d) To 15.00 ¶In 200-lb. steel barrels. ‖Refund for return of barrels. †To 17.50, plus bags as supplied. (x) Ohio Ritewall hair-fibered finishing lime, per ton, in 50-lb. paper bags, 9.00. *To 16.00. ‡To 13.00.

Stone-Tile Hollow Brick

Prices are net per thousand, f.o.b. plant.

	No. 4	No. 6	No. 8
Albany, N. Y.*†	40.00	60.00	70.00
Altadena, Calif.	45.00	55.00	65.00
Asheville, N. C.	30.00	40.00	50.00
Atlanta, Ga.	29.00	42.50	53.00
Auburn, Wash.	.....	50.00	65.00
Brownsville, Tex.	.....	53.00	62.50
Brunswick, Me.	29.50	42.25	55.00
Chula Vista, Calif.	32.50	42.50	50.00
Daytona Beach, Fla.	45.00	55.00	65.00
Frostproof, Fla.	45.00	65.00	75.00
Houston, Tex.	36.00	53.00	66.00
Klamath Falls, Ore.	50.00	60.00	70.00
Longview, Wash.‡	.....	50.00	60.00
Los Angeles, Calif.	29.00	39.00	45.00
Macon, Ga.	25.00	35.00	45.00
Mattituck, N. Y.	45.00	55.00	65.00
Medford, Ore.	50.00	55.00	70.00
Memphis, Tenn.	45.00	50.00	60.00
Mineola, N. Y.	40.00	50.00	60.00
Nashville, Tenn.*	32.00	50.00	60.00
New Orleans, La.	45.00	55.00	65.00
Norfolk, Va.	33.00	46.00	60.00
Palm Springs, Calif.	45.00	60.00	70.00
Passaic, N. J.	42.50	55.00	75.00
Pawtucket, R. I.	27.50	41.25	55.00
Presidio, Tex.	55.00	65.00	75.00
Roanoke, Va.	32.50	40.00	50.00
Salem, Mass.	40.00	60.00	75.00
San Antonio, Tex.	37.00	46.00	60.00
San Diego, Calif.	35.00	44.00	52.50
Spartanburg, S. C.	32.50	40.00	52.50

Prices are for standard sizes—No. 4, size 3½x4x12 in.; No. 6, size 3½x6x12 in.; No. 8, size, 3½x8x12 in. *Delivered on job. †10% discount. ‡Stonetile, per 1000 at plant, 4x6x8, 55.00; 4x8x8, 64.00.

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point.

Camden, N. J.:			
8x8x16 in., each	.....	.....	.16a
Lexington, Ky.:			
8x8x16 in.	.....	.....	‡18.00*
8x8x16 in.	.....	.....	†16.00*
Omaha, Neb. (Prices delivered):			
8x8x16 in., each	.....	.12¶	.14‡
8x12x16 in., each	.....	.16¶	.18‡
8x4x16 in., each	.....	.07½¶	.09½‡
Wichita, Kan.:			
4x8x16 in., each	.....	.....	.07

*Price per 100 at plant. †Rock or panel face. ‡Face. ¶Plain. (a) Less 10%.

Cement Drain Tile

Longview, Wash.—Price per foot.

3-in.	.05	6-in.	.10
4-in.	.06	8-in.	.15

Cement Roofing Tile

Prices are net per square, carload lots, f.o.b. nearest shipping point, unless otherwise stated.

Cicero, Ill.—French and Spanish tile, 9x15-in., per sq.	9.50–12.00
Closed end shingle, 8½x12½ in., per sq.	11.00–13.00
New York City, N. Y.—9x15 in., red, per sq., 10.00; green, per sq.	12.00

Rock Phosphate

Prices given are per ton (2240 lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Mt. Pleasant, Tenn.—B.P.L., 75%, screened machine lump, per ton, 6.25; hand mined kiln lump	4.00– 6.00
B.P.L., 72%, per ton	4.75– 5.25

Ground Rock
(2000 lb.)

Mt. Pleasant, Tenn.—	
Lime phosphate, B.P.L. 75%; per ton, bags extra	*12.80
Raw rock phosphate, B.P.L. 60-65%, per ton	†6.00– 9.00
Ground rock, B.P.L. 72%, per ton	5.00– 5.50

*85% thru 300 mesh.
†40-80% thru 300 mesh.

Florida Phosphate
(Raw Land Pebble)

Mulberry, Fla.—Gross ton, f.o.b. mines	
68/66% B.P.L.	3.15
70% minimum B.P.L.	3.75
72% minimum B.P.L.	4.25
75/74% B.P.L.	5.25
77/76% B.P.L.	6.25

Cement Building Tile

Lexington, Ky.:		
5x8x12, per 1000		55.00
4x5x12, per 1000		35.00
Longview, Wash.:		
4x6x12, per 1000		50.00
4x8x12, per 1000		56.50
Wichita, Kan. (Duntile)	Plain	Glazed
8x8x12-in., each	.08	....
6x8x12-in., each	.07	....
6x6x12-in., each	.06	....
4x5x12-in., each	.05	.08
4x4x12-in., each	.04	.07½

Concrete Brick

Prices given per 1000 brick, f.o.b. plant.

	Common	Face
Longview, Wash.	16.50	†22.50
Milwaukee, Wis.	12.50	20.00
Omaha, Neb.	15.00	.....
Rapid City, S. D.	14.00	30.00
Wichita, Kan., per 100	*8.00	*8.50

*8x8x16 size. †And higher.

Potash Feldspar

Bedford Hills, N. Y.—Color, white; analysis, K_2O, 11%; Na_2O, 2.50%; SiO_2, 68%; Fe_2O_3, 0.06%; Al_2O_3, 18.25%; pulverized, 99% thru 20 mesh; per ton, in bags, 11.45; bulk.. 10.25

Keystone, S. D.—Color, white; analysis, K_2O, 12.50%; Na_2O, 2.25%; SiO_2, 65%; Fe_2O_3, 0.04%; Al_2O_3, 19.50%; pulverized, 99% thru 200 mesh, in bags, per ton, 16.20; bulk.... 15.00

Kingman, Ariz.—Color, white; analysis, K_2O, 12.50%; Na_2O, 2.25%; SiO_2, 65%; Fe_2O_3, 0.06%; Al_2O_3, 18.65%; pulverized, 98% thru 200 mesh, in bags, per ton, 19.20; bulk.... 18.00

Spruce Pine, N. C.—(Chemically controlled.) Color, white; 200 mesh; analysis, K_2O, 11.30%; Na_2O, 2%; SiO_2, 67%; Fe_2O_3, 0.10%; Al_2O_3, 18%; per ton, in bulk.... 15.00

Spruce Pine, N. C.—Color, white; analysis, K_2O, 10%; Na_2O, 2.50%; SiO_2, 69%; Fe_2O_3, 0.08%; Al_2O_3, 17.75%; pulverized, 99% thru 20 mesh; in bags, per ton, 10.70; bulk.. 9.50

Topsham, Me.—White; analysis, K_2O, 9.50%; Na_2O, 3.50%; SiO_2, 72%; Fe_2O_3, 0.09%; Al_2O_3, 16.75%; pulverized, 98% thru 200 mesh; per ton in bulk, 17.00; in bags.... 18.20

Trenton, N. J.—White; analysis, SiO_2, 68%; Na_2O, 2.75%; K_2O, 10%; Fe_2O_3, 0.06%; Al_2O_3, 18%, pulverized, 99% thru 200 mesh; per ton, in bulk, 19.00; in bags, per ton.... 20.20

West Paris, Me.—(Chemically controlled.) Color, white; 200 mesh; analysis, K_2O, 11.20%; Na_2O, 3.20%; SiO_2, 65.70%; Fe_2O_3, 0.09%; Al_2O_3, 19.20%; per ton, in bulk.... 19.00

Soda Feldspar

Spruce Pine, N. C.—(Chemically controlled.) Color, white; 200 mesh; analysis, K_2O, 5.50%; Na_2O, 5.50%; SiO_2, 68.80%; Fe_2O_3, 0.10%; Al_2O_3, 18.60%; per ton, in bulk.... 18.00

Fullers Earth

Prices per ton in carloads, f.o.b. Florida shipping points. Bags extra and returnable for full credit.

16– 30 mesh	20.00
30– 60 mesh	22.00
60–100 mesh	18.00
100 mesh and finer	9.00
Joliet, Ill.—All passing 100 mesh, f.o.b. Joliet, including cost of bags	22.00

Whiting

St. Louis, Mo., per ton	15.00*
Chicago, Ill., prices per ton.	
Domestic putty whiting	10.00–12.00
Domestic precipitated whiting	15.00–20.00
Imported bolted whiting	30.00–35.00
Philadelphia, Penn.—English chalk whiting packed in 50-lb. paper bags, per ton, in carloads	15.00

*Packed in bbl., f.o.b. St. Louis.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted

Culvert and Sewer	4-in.	6-in.	8-in.	10-in.	12-in.	15-in.	18-in.	20-in.	22-in.	24-in.	27-in.	30-in.	36-in.	42-in.	48-in.	54-in.	60-in.
Grand Rapids and Saginaw, Mich.																	
Sewer	.....	.08½	.13½	.20	.25¾	.39¾	.62½	.75	1.00	1.12½	1.62½	1.80	.....	.....	.....	.....	.....
Culvert (b)	.....	.....	.....	.55	.60	1.10	1.35	1.60e	.....	1.80	2.00	2.25	3.10	4.00	5.50	.....	.....
Longview, Wash.																	
Culvert	.....	.30	.45	.....	.55	.....	1.05	.....	.....	1.54	.....	2.70	4.00	5.00	6.00	.....	.....
Sewer	.17½	.21	.30	.42	.45	.90	1.26	.....	.....	2.16	.....	3.60	.....	.....	.....	.....	.....
Newark, N. J.																	
Unreinforced	.08	.16	.26	.36	.46	.56	.90	1.10	1.26	1.50	.....	.....	.....	.....	.....	.....	.....
Reinforced	.....	.....	.....	.....	.90	1.05	1.40	1.60	1.75	2.05	2.60	3.00	4.00	5.00	6.00	8.50	12.00
Wahoo, Neb.	12-in., 15-in., 18-in., 24-in., and from 30-in. to 60-in. pipe, per ton, 10.00																

(a) Reinforced. (b) To contractors. (e) 21-in. pipe.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F.O.B. MILL

City or shipping point	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gaging Plaster	Wood Fiber	Gaging White	Plaster Sanded	Cement Keene's	Finish Trowel	—Plaster Board— ⅜x32x 36". Per M Sq. Ft.	—Plaster Board— ½x32x 36". Per M Sq. Ft.	Wallboard, ⅜x32 or 48" Lengths 6'-10'. Per M Sq. Ft.
East St. Louis, Ill.—3x18-in. partition sections cast up to 13 ft. in length, 10c per surface ft.; 4x12-in. partition sections cast up to 10 ft. in length, 12c per surface ft.; 6x6-in. partition sections cast up to 10 ft. in length, 20c per surface ft.; 7x16-in. floor sections cast up to 13 ft. in length, 17c per surface ft.; precast fireproofing sections for ceilings, beams and columns are priced at 12c per surface ft.													
Grand Rapids, Mich.	.....	1.50	7.00	.....	10.00	10.00	19.50	8.00	26.00	21.00	15.00	15.00	27.00
Los Angeles, Calif. (r)	.....	.....	8.02p	.....	12.40q	.....	13.40a	.....	.....	.....	.....	.....	.....
Medicine Lodge, Kan.	.....	.....	.....	.....	.....	.....	11.50b	.....	16.00b	.....	.....	.....	.....
Port Clinton, Ohio	4.00	6.00–8.00	6.00–8.00	10.00m	10.00n	10.00n	20.00k	8.00–11.00	24.50f	26.00g	15.00h	15.00h	27.00j
Winnipeg, Man.	5.00	5.00	7.00	14.00	15.00	15.00	.....	.....	.....	.....	20.00	25.00	33.00d
Woodville, Ohio	.....	.....	.....	.....	.....	.....	.....	.....	25.50b	.....	.....	.....	.....

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable). (a) To 14.40 per ton. (b) Includes paper bags. (c) Includes jute sacks. (d) "Gyproc," ⅜x48-in. by 5 and 10 ft. long. (f) To 27.50. (g) To 29.00. (h) To 16.00. (j) To 28.00. ((k) To 23.00. (m) To 12.00. (n) To 13.00. (p) To 9.02. (q) To 14.40 per ton. (r) Plaster board, 16x48—$\frac{3}{16}$ in., per yd., 14½–15½c; 16x48—⅜ in., per yd., 16½–17½c.

Warner Co. Adds Concrete Products Department

A NEW DEPARTMENT of the Warner Co., Philadelphia, Penn., has been established, known as the precast concrete products department, which will manufacture various products from concrete.

This new department will be a unit in the sales and retail yards division and will be in charge of Charles Shoemaker, as manager. It has been formed only after considerable preliminary study and investigation of markets, cost of production, etc., the company states. At the present time it is proposed to manufacture only reinforced-concrete pipe, but the scope of the new department in all probability will be widened to include other precast articles. Some of these are already being investigated.

Another function of this department will be to bid on special precast products where a reasonable quantity production is needed. Such special work may be performed at any of its retail yards from Morrisville to Wilmington.

The first step along these lines will be the establishment of a reinforced concrete pipe manufacturing unit at the Tyson St. yard in Philadelphia. Arrangements are being made with the Lock Joint Pipe Co., of Ampere, N. J., to superintend the manufacture of this pipe and Warner Co. will act as the selling and distributing agents, the *Warner-American News* states.

California Company Adds to Plant

THE Atlas Olympia Co. of California, San Francisco, Calif., which changed hands in October, 1931, recently announced that the plant will be enlarged and improved on an extensive scale. Work has already commenced. Much new machinery will be installed and the plant will be generally overhauled. Officials hope to have the changes and improvements completed within the next 30 days in order to handle several large contracts which have been arranged for.

During the past two years the plant has not operated to capacity owing to the general business slump. However, officials of the company believe conditions are improving and within the next few months the plant will once more be back on full-time schedule.

A specialty material is produced at the plant known as "Atrock" which is gaining recognition throughout the state. Atrock is a medium-priced paving material ready to lay which is particularly adapted to secondary road work, etc.

The company also operates a plant at Felton, Santa Cruz county, and maintains general offices in San Francisco.—*Oakdale* (Calif.) *Leader.*

Office for New Cement Plant Under Way

CONSTRUCTION work has been started on the office of the National Portland Cement Co. at Brodheads, Penna., Bethlehem-Nazareth pike. With favorable weather, is is expected the structure will be under roof early in May. This project was announced in ROCK PRODUCTS March 12.

The building will be of early Moravian architecture, 60 ft. long by 30 ft. wide, two stories high. The first floor will contain the physical and chemical laboratories and the engineering offices. The second floor will contain the reception room, the directors' room and general manager's office, and offices for the plant accounting, purchasing and shipping departments, telephone exchange and clerical staff.

The structure is being erected on the plant site and commands a clear view of the cement plant and the quarry.

At a meeting held in the main office of the company in Philadelphia, Hugh J. Larkin, of Bethlehem, was elected a member of the board of directors.—*Allentown* (Penn.) *Call.*

New Ready Mixed Concrete Plant in Austin, Tex.

L. D. McKAUGHAN of Houston, Tex., has installed a ready mixed concrete plant at Austin. Mr. McKaughan has closed contracts to supply the concrete for foundations and structures of six of the nine new University buildings, it is reported. He also has closed arrangements to furnish the city the prepared material for some future street and sewer work. Contractors bidding on the $500,000 highway building to be placed under contract April 11 have negotiated for prices on the concrete supply as well.

The plant includes a dragline and other equipment and Mr. McKaughan is installing a fleet of eight trucks, and has stores of sand, gravel, crushed rock and cement on hand for the operation of his plant.

He is able to furnish the ready-mixed concrete at prices averaging $5 per cu. yd., it was stated. Present contracts provide for a year's operation of the plant, and approximately a dozen men are employed in addition to the drivers of the trucks.

To Manufacture Dry Ice

THE Michigan Alkali Co. opened the largest plant in the world for the production of solid carbon dioxide, known as "dry ice," at Wyandotte, Mich., April 1. A single day's output of the product will be equal in refrigerating efficiency to 1500 tons of ice, since solidified gas is 140 deg. colder than water ice and the weight of a 10-in. cube is more than 45 lb. The company will use for raw material a part of the 2000 tons of carbon dioxide gas given off daily in the production of lime for soda ash, one of the major operations of the company.

Last year's consumption of dry ice is reported as more than 100,000,000 lb. as compared to 1,000,000 lb. in 1926.—*Michigan Contractor and Builder.*

RETAIL MATERIAL PRICES, DELIVERED, MARCH 1, 1932 (COMPILED BY DEPATRMENT OF COMMERCE)

City	Portland cement, per bbl. exclu. of cont.	Gypsum wallboard, ⅜-in., per M	Hydrated lime, per ton	Building sand, per cu. yd.	Crushed stone, ¾-in., per ton	Gypsum plaster, neat, per ton
New Haven, Conn.	$2.40	.....	$15.00	$1.50	$2.00	.....
New London, Conn.	2.05	25.00	18.00	1.50	3.00	$18.00
Waterbury, Conn.	2.60	30.00	18.00	1.10	2.45	18.00
Haverhill, Mass.	2.40	25.00	16.00	.....	.....	17.50
New Bedford, Mass.	2.40	24.00	16.50	1.50	2.75	16.50
Buffalo, N. Y.	2.95	21.00	18.00	2.50	2.05	16.00
Poughkeepsie, N. Y.	1.95	.....	26.00	2.25	2.20	13.00
Rochester, N. Y.	2.28	22.00	14.50	2.25	2.40	16.00
Syracuse, N. Y.	2.60	20.00	.....	1.80	1.60	14.00
Paterson, N. J.	2.00	24.00	18.00	1.50	2.10	17.50
Trenton, N. J.	2.10	30.00	13.50	1.60	1.50	14.50
Philadelphia, Penn.	2.10	.....	13.75	1.75	2.60	17.50
Scranton, Penn.	2.40	30.00	20.00	3.25	.....	19.00
Baltimore, Md.	2.10	25.00	13.00	1.85	2.50	15.50
Washington, D. C.	1.65	22.50	12.00	.....	.....	14.00
Richmond, Va.	2.90	.....	21.00	1.65	2.10	18.00
Fairmont, W. Va.	2.60	35.00	16.00	2.70	3.25	18.00
Atlanta, Ga.	2.55	36.00	15.50	2.81	2.50	20.15
Tampa, Fla.	2.40	.....	24.00	2.00	3.50	.....
New Orleans, La.	2.35	.....	14.00	1.85	.....	18.00
Akron, Ohio	1.81	.....	14.00	1.50	2.50	15.50
Cincinnati, Ohio	$2.40	$25.00	$14.00	$2.36	$2.50	.....
Cleveland, Ohio	2.00	.....	12.00	1.69	2.15	$18.00
Toledo, Ohio	1.40	21.00	12.00	1.40	1.60	14.00
Youngstown, Ohio	2.43	23.25	16.00	2.50	2.50	18.00
Detroit, Mich.	2.00	25.00	12.00	1.50	1.75	15.00
Lansing, Mich.	2.25	.....	20.00	1.80	1.80	17.50
Saginaw, Mich.	1.90	22.00	16.00	2.50	2.20	18.00
Terre Haute, Ind.	2.00	28.00	18.00	1.25	3.00	18.00
Louisville, Ky.	1.86	.....	15.00	2.00	2.15	17.00
Milwaukee, Wis.	1.25	22.00	14.00	1.10	1.10	15.20
Des Moines, Iowa	1.82	23.50	18.00	1.40	.....	14.00
Wichita, Kan.	1.75	25.00	22.50	1.00	.....	15.50
Kansas City, Mo.	2.10	25.00	22.00	1.60	1.88	17.00
St. Louis, Mo.	2.00	.....	16.00	1.35	1.65	16.00
St. Paul, Minn.	2.15	21.00	19.00	1.25	1.75	17.00
Grand Forks, N. D.	2.60	.....	28.00	2.60	.....	19.00
Sioux Falls, S. D.	2.00	40.00	22.00	1.25	2.00	15.00
San Antonio, Tex.	2.41	39.00	20.00	2.00	2.00	19.15
Tucson, Ariz.	3.29	45.00	30.00	1.25	2.25	17.10
Los Angeles, Calif.	2.30	23.50	24.70	1.25	1.40	15.20
San Francisco, Calif.	.....	47.50	22.50	1.40	1.60	17.30

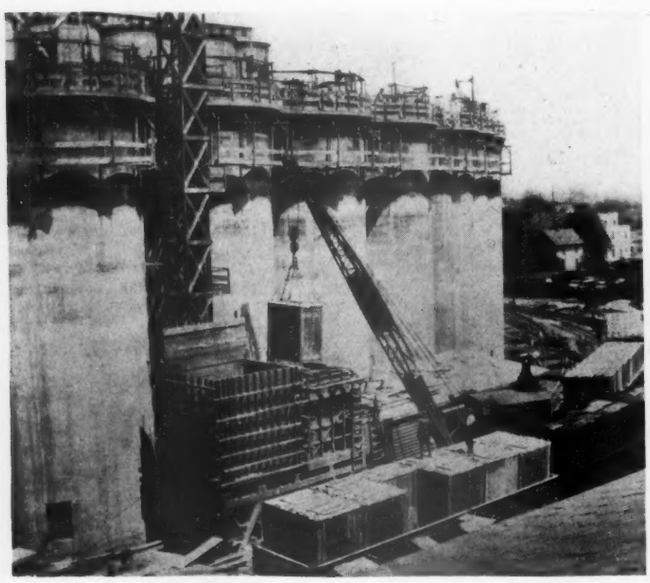
Side door containers loaded on special drop door car and moved by lift truck

Drop bottom containers being unloaded direct to trucks

Improved Methods of Transporting Bulk Commodities

THE handling of bulk commodities in containers as shown in the accompanying illustrations is not new, having been used a number of years; but the method has been coming into more general use and offers advantages in certain cases.

The drop bottom container shown in several of the illustrations is adapted to the economical handling of such commodities as bulk cement, lime, sand, etc., and has also been used advantageously for handling coarse or fine aggregates such as crushed stone and gravel.



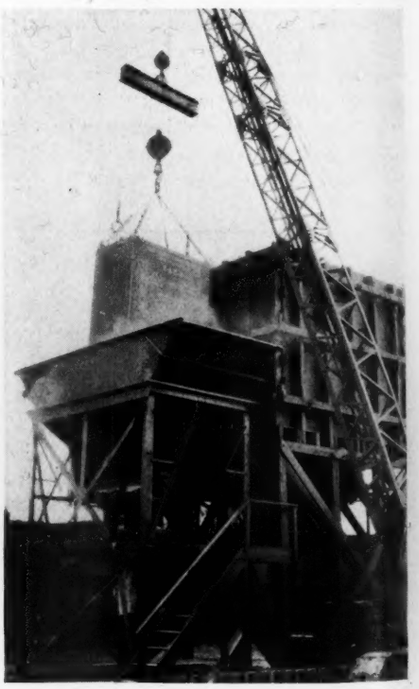
Use of drop bottom containers for mixing plant on concrete silo job

Side Door Container

The merchandise container with side doors, shown in some of the illustrations, was developed and put into use about seven years ago as an improvement over the old methods of handling L.C.L. shipments. By its use individual shipments are sent through without rehandling, crating and packing costs are avoided, and claims for damage or loss practically eliminated. The container can be loaded by the shipper (at his plant if desired), locked or sealed, and unloaded by the consignee and cannot be opened on the car en route. These containers are approximately 7 ft. wide by 8½ ft. long by 7 ft. high inside, with a capacity of 426 cu. ft. or 10,000 lb., and a light weight of 3000 lb. They are easily transferred by crane between railroad cars and trucks or trailers and are also movable by small lift type trucks when used in special drop door cars. Six containers are loaded in one railroad car. In the rock products field they are particularly adapted to the shipment of gypsum blocks and similar products.

Drop Bottom Container

The drop bottom brick container followed and has been in use about five years. It can be loaded on the car at the plant by conveyor or otherwise and is emptied by a crane direct to trucks. The result is a considerable saving of time and labor in unloading. It is equally well adapted to the handling of crushed stone or gravel. In 1927 such con-



Drop bottom container used with batching plant

tainers were used in filling a breakwater crib at Cleveland, Ohio, by loading on the car with stone at the quarry and then transferring to barges and emptying by crane. This

Side door containers loaded on trailers

type of container is approximately 4 ft. wide by 7 ft. long by 7½ ft. high inside, with a capacity of 210 cu. ft. and an average light weight of 2300 lb.

Drop bottom containers being unloaded direct to trucks

Containers for Cement and Lime

An improved container of this type with a rain proof top door and leak proof bottom hinged doors has been used in handling bulk cement and lime. These carry a load of 10,000 lb. and have a light weight of 2300 lb. One row of 10 containers or 12 containers in two rows of six are loaded on one railroad car.

In this way one car of containers will carry twice the usual box car loading and can be unloaded in one-half the time, thus giving an efficiency of car utilization of about four times.

This method of handling cement and aggregates on construction jobs has been successfully used in the East and lime is also being handled in bulk in such containers by one of the Ohio lime producers.

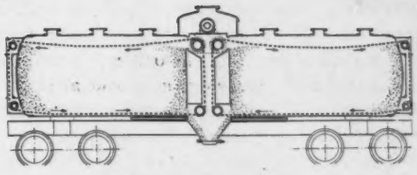
The containers shown are those used by the L.C.L. Corp., which is a subsidiary of the New York Central railroad.

Self-Unloading Tank Car for Full-Car Shipment of Bulk Commodities

A TANK CAR designed especially for shipment of bulk cement, lime, silica sand and other materials having a natural tendency to flow, is announced by the General American Tank Car Co., Chicago, Ill. It will handle materials up to egg size. In experimental trips it has carried cement, pebble and hydrated lime, soda ash, crushed slag, and volcanic ash.

This car has a cubical capacity of 1600 cu. ft. and will carry 130,000 lb. of cement. It may be loaded through six manholes 16 in. in diam. on top of the car, though it is said that each end of the car may be loaded to capacity with cement through one manhole. There is little dusting when loading, the manufacturer states. A capacity load of cement may be loaded in 30 min.

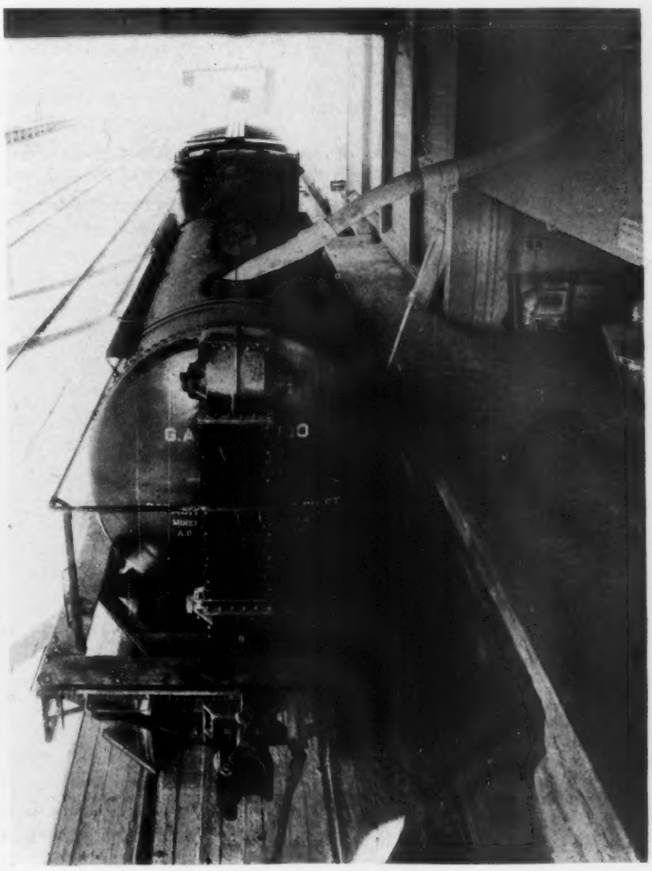
In construction the car is divided in three parts: two large sections for holding the material, and a center section that contains unloading equipment. The two material sections



Section through car

are designed so that material will flow freely to the bottom of the car in unloading. The discharge is from one hopper at the center of the car. It is claimed that with free-flowing materials 25% of the load will be discharged by gravity. The remainder of the load is removed by drag chains, whose plan of operation is shown in an accompanying illustration. Either chain may be operated singly or they may be operated at the same time. This gives flexibility in unloading. A car may be unloaded by one man in approximately two hours. The unloading mechanism is operated by a ball bearing motor arranged to suit the customer's requirements. A plug for electrical connection is placed on the motor. A "twin disc" friction clutch is placed between the motor and speed reducers to facilitate starting and stopping. A heavy design, special, endless drag chain, 14 in. wide, is provided for each compartment.

The unloading hopper is equipped with gasketed sliding gate, which is bolted and sealed in the closed position for shipment.



Loading car through end manhole

Features claimed for the car are that it provides moisture-proof shipment, automatic dustless loading and unloading, simplified collecting and conveying equipment at plants, elimination of packaging expense, and saving of two manual operations. Economies are greatest where bags may be eliminated by its use. There are also certain applications where, by removing the dangers of human contact, less expensive materials may be substituted for those now used. The substitution of quicklime for hydrated lime is one example of such savings. The rock products industry should find many uses for this equipment.

Belt Conveyor Theory and Practice

Part II—Power Required

By G. F. Dodge, M.E.

WITH the width and speed tentatively set the power requirements may be investigated. The word "tentatively" is used because the figures on the power requirements and the resulting belt stresses may call for a change in the selection.

As a power problem the drive of a conveyor belt follows the same laws as for an ordinary transmission belt but there the similarity ends. In the ordinary transmission problem the resistance is all concentrated at the driven pulley, whereas in a conveyor it is made up of a number of small increments mostly distributed throughout the entire length of the belt, both top and bottom strands. These items are:

1. Friction in the bearings of the troughing idlers due to the weight of the rotating parts.
2. Friction in the bearings of the troughing idlers due to the weight of the top strand of belt.
3. Friction in the bearings of the troughing idlers due to the weight of the material being carried.
4. Friction in the bearings of the return idlers due to the weight of the rotating parts.
5. Friction in the bearings of the return idlers due to the weight of the bottom strand of belt.
6. Friction in the bearings of tail, snub and other fixed pulleys (exclusive of drive and fixed or traveling trippers) due to the weight of the rotating parts and the belt pulls they may resist.
7. Power required to lift the load if the conveyor is all or partially inclined.
8. Power required to lift the load to the discharge point of the tripper or trippers if there are any. This is best added to item 7 and the total lift considered as one item.
9. Friction of turning the pulleys of the trippers if any are used.

These nine items make up the resistances that have to be overcome by the belt and are a measure of the power that has to be transmitted to it by the drive. They produce what is commonly called the "horse power pull." Three other items have to be considered, however, in arriving at the total pull on the belt and have to be added to the horsepower pull. They are:

10. The necessary slack side tension to produce adhesion on the driving pulley or pulleys.
11. In the case of inclined conveyors the component of the weight of the inclined portion of the belt.
12. In the case of some inclined conveyors, an added pull at the tail to prevent sagging of the belt between the troughing idlers at and near the loading point. This item never occurs unless item 10 is insufficient.

Editors' Note

IN PART I of this series of articles, published in* Rock Products, *December 5, 1931, the author showed how to determine the proper speed and width of a belt conveyor for any given capacity and for various kinds and sizes of materials.

In the present article detailed methods are given for computing the power requirements.

—The Editors.

While items 1 to 9 inclusive give the power that has to be transmitted to the belt, they do not make up the total motor power. There has to be added the friction of the drive pulley bearings and the gear reduction losses.

Items 1, 2, 4, 5 and 6 taken together fix the "belt" power of the empty conveyor (exclusive of trippers) and are combined into a coefficient called the "conveyor coefficient." It is directly proportional to the speed and the length of the conveyor.

Item 3 fixes the "belt" power required to *transport* the load and is called the "load coefficient." It is proportional to the load in tons per hour and the length, but is independent of the speed, as the weight per foot on the belt varies as the density of the material and inversely as the speed (cross section of load is constant).

Items 7 and 8 as stated before are taken together as total lift.

Item 9 is given as a definite tabular horsepower and is fixed by the width only by at least one manufacturer, and by width and speed by another. Considerable error may enter by either method, as they both ignore the effect of varying belt pull in producing bearing friction. A more logical and accurate result is obtained by adding a percentage to the sum of all other "belt" horsepowers. A number of computations made with varying conditions indicate that 3% is a safe average for each tripper friction with plain bearings and 2% with roller bearings.

Simplifying Formulae

An inspection of the preceding rather formidable list of elements going into the makeup of "belt" horsepower indicates the necessity of combining as many as possible to avoid too extended computations. It is obvious that there would be different coefficients resulting for every difference in the following:

1. Difference in idler pulley weights.
2. Difference in ratio of shaft diameter to idler pulley diameter.
3. Difference in spacing of idlers.
4. Difference in weight of belt.

Fortunately in the interest of the application of one set of formulæ most manufacturers are pretty well in agreement on these items. Two weights of pulleys (light and heavy) and one ratio of diameters (1-in. to 6-in.) cover most conditions; likewise, two spacings of idlers, one for material up to 75 lb. and another for 75 lb. to 125 lb. per cu. ft. The belt may vary from minimum to maximum plies for any case, but as the weight of the belt is a small percentage of the whole, no excessive error will enter if the belt weight is taken as that of the average or next above average permissible number of plies. This reduces the conveyor coefficients to six (three for plain bearing and three for roller bearing), and the load coefficients to two (one plain bearing and one roller bearing). If any material variation from these standard proportions are proposed, however, the coefficients must be adjusted accordingly.

The following table of idler spacing is conservative and represents a fair average of general practice:

TABLE V—IDLER SPACING—RETURN IDLERS SPACED 10 FT. 0 IN. IN ALL CASES

Width of conveyor	Spacing of Idlers: Material up to 75 lb. per cu. ft.	Material weighing 75 to 125 lb. per cu. ft.	Material above 125 lb. per cu. ft.
16-in.	5 ft. 0 in.	4 ft. 6 in.	.....
18-in.	4 ft. 6 in.	4 ft. 6 in.	.....
20-in.	4 ft. 6 in.	4 ft. 6 in.	.....
24-in.	4 ft. 6 in.	4 ft. 0 in.	4 ft. 0 in.
30-in.	4 ft. 6 in.	4 ft. 0 in.	3 ft. 6 in.
36-in.	4 ft. 0 in.	3 ft. 6 in.	3 ft. 0 in.
42-in.	4 ft. 0 in.	3 ft. 6 in.	3 ft. 0 in.
48-in.	3 ft. 6 in.	3 ft. 0 in.	2 ft. 9 in.
54 in.	3 ft. 6 in.	3 ft. 0 in.	2 ft. 9 in.
60-in.	3 ft. 6 in.	3 ft. 0 in.	2 ft. 9 in.

With idlers spaced according to Table V and weights of *average* belts from Table I, Part I, the weights of moving parts were

TABLE VI—POWER COEFFICIENTS

Width of conv.	Plain bearing idlers: 3/16-in. pulley rims: 25 to 75 lb. material Conv. coef.	Load coef.	75 to 125 lb. material Conv. coef.	Load coef.	Plain bearing idlers: ⅜-in. rims: 125 to 200 lb. material Conv. coef.	Load coef.	Roller bearing idlers: 3/16-in. pulley rims: 25 to 75 lb. material Conv. coef.	Load coef.	75 to 125 lb. material Conv. coef.	Load coef.	Roller bearing idlers: ⅜-in. rims: 125 to 200 lb. material Conv. coef.	Load coef.
16-in.	.031	.067	.035	.067	.....	.....	.016	.033	.018	.033	.....	.....
18-in.	.035	.067	.039	.067	.....	.....	.018	.033	.020	.033	.....	.....
20-in.	.040	.067	.044	.067	.....	.....	.020	.033	.022	.033	.....	.....
24-in.	.050	.067	.055	.067	.068	.067	.025	.033	.028	.033	.034	.033
30-in.	.066	.067	.074	.067	.086	.067	.033	.033	.037	.033	.043	.033
36-in.	.085	.067	.100	.067	.110	.067	.043	.033	.050	.033	.055	.033
42-in.	.108	.067	.123	.067	.133	.067	.054	.033	.062	.033	.067	.033
48-in.	.132	.067	.146	.067	.172	.067	.066	.033	.073	.033	.086	.033
54-in.	.155	.067	.176	.067	.....	.....	.078	.033	.088	.033	.....	.....
60-in.	.188	.067	.215	.067	.....	.....	.094	.033	.106	.033	.....	.....

determined. These in combination with the ratio of diameters (1-in. to 6-in.) and a coefficient of friction that has been proven to cover cold weather conditions (40%) give the pull per foot of length to move the empty belt. Divided by 33,000, this gives the horsepower per foot of length at a speed of 1 ft. per min., the "conveyor coefficients" for plain bearing idlers. As these come out in unwieldy decimals they are made more easy to handle by expressing them as the coefficients per 1000 ft. of length as in Table VI. Any of these "conveyor coefficients" multiplied by the speed (ft. per min.) and one 1000th of the length gives the "belt" horsepower to run that conveyor empty. Similarly the "load coefficients" per 1000 ft. of length (Table VI) are found to be constants that have to be multiplied simply by the tons per hour and length ÷ 1000 to get the power to transport the load the length of the conveyor.

Definite coefficients of friction of roller bearings are difficult to obtain from manufacturers so actual operations had to be resorted to. Tests on quite a number of conveyors indicate that 50% of plain bearing friction is a good average with a tendency to fall off in the wider sizes. However, as wide conveyors may be more readily overloaded, it is sound practice to use 50% throughout and Table VI is so constructed.

The completed formula for the power requirement of any conveyor then becomes:

Conveyor coefficient × speed..... $= a$

Load coefficient × tons per hour..... $= b$

$$\frac{(a+b) \times \text{length}}{1000} = c = \text{friction hp. of level conveyor without tripper.}$$

$$\frac{\text{T.P.H.} \times \text{ft. lift}}{1000} = d = \text{hp. of lift.}$$

$c + d = e$ = total "belt" hp. for inclined belt without tripper.

c or $e + 3\% = f$ = "belt" hp. with one plain bearing tripper.

c or $e + 2\% = f_1$ = "belt" hp. with one roller bearing tripper.

c, e, f or f_1 + drive loss = motor output.

Losses With Various Types of Gears

Drive loss with spur gears and shafting, 12½%.

Drive loss with herringbone reducer, 8%.

Drive loss with worm gear reducer varies with the ratio of reduction and becomes serious with high ratios.

To cover starting under load and possible surges or overloads the *continuous* rating of the motor should be at least 15% above the figured output for narrow conveyors and 20% for conveyors 30 in. wide and over. Also the motor should preferably have high torque starting characteristics.

With a and b kept separate as they are in this formula, it is possible to figure the horsepower for not only a fully loaded conveyor but for one carrying any fraction of its rated capacity. When the material is of a nature that will not cause damage to the belt considerable saving may often be made by running it faster than is required for normal loading, and this at the expense only of a proportionate increase in power in the a portion of the formula.

The savings may come from a simpler drive, or a thinner belt with resulting smaller pulleys, shafting and better reduction gear ratios. In extreme cases the load on the belt may be sufficiently reduced to permit wider spacing of idlers, and sometimes the use of one conveyor instead of two. In fact the last is probably the most frequent justification of "speeding," as the wear on the belt due to a thinner stream may be more than offset by the reduction in wear obtained by cutting out one transfer, and further a saving in length results on inclined belts of about three times the height required for the transfer. When "speeding" is resorted to the feed must be controlled to the figured amount or serious overloading is certain to result. Judgment backed by experience should be the principal guide in a decision as to "speeding," however, for it must be borne in mind that the belt cost may be 40 to 50% or more of the total, and as the machinery will outlast several belts, saving in machinery at the expense of belts may prove false economy. An investigation of the desirability of "speeding" is rarely made unless computations for belt thickness show the proposed installation would be out of balance.

With the "belt" horsepower determined by the power formula, the horsepower pull is found from:

$$\text{Horsepower pull} = \frac{c, e, f \text{ or } f_1 \times 33{,}000}{\text{Belt speed}}$$

This is the pull at the drive necessary to move the loaded belt. The other elements going to make up the *total* belt pull are those previously mentioned, items 10, 11 and 12 under the list of power elements; that is, slack side tension and component of the weight of the inclined belt, with sometimes an added tension to prevent sagging between the idlers at the loading point of inclined conveyors. The component of the weight of the inclined portion of the belt is simple, being the product of the weight per foot multiplied by the lift in feet. The slack side tension and possible sagging tension, however, require an intimate knowledge of the effects of different types of drives and their locations. These will be discussed in a following article describing various drives.

(To be continued)

Pennsylvania-Dixie Contracts for Limestone Supply in Iowa

THE Winterset Limestone Co. quarry east of Winterset, Ia., has a force of men at work clearing the debris from the shale so that the quarry may be drained and railroad tracks laid through it. As soon as the spurs are laid from the Rock Island tracks a full force of men will be employed in getting out rock for a large contract for the Pennsylvania-Dixie Cement Corp. plant at Valley Junction.

The Winterset company is to furnish the Pennsylvania-Dixie corporation its season's requirements of limestone rock, shale and screenings, totaling approximately 150,000 tons to be shipped at the rate of 25 cars a day.

This will necessitate the construction of a side track from the Rock Island right of way into the quarry property. Thirty-five hundred feet of storage track will be constructed on the Rock Island right of way.

The Winterset Limestone Co. spent $50,000 in the quarry last year getting out rock and developing the rock faces which are on either side of a small gully. It will spend as much or more than that this year. The north side rock face will be used for the cement and the south side face will furnish material for crushed rock.

After the north quarry has been cleared the company will open the Ladore shale that is the floor of the quarry and will use it to mix with the rock in making cement. It will be several weeks before shipments can begin.

This contract will not interfere with production for commercial purposes.—*Winterset* (Ia.) *News*.

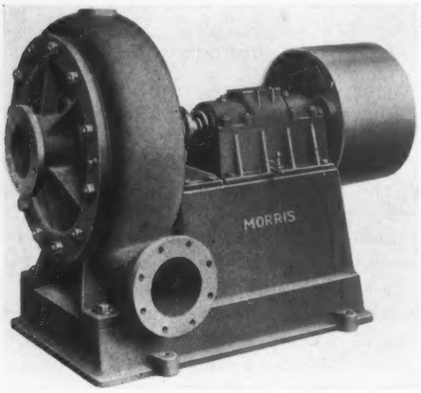
Texas Potash Development

ON THE BASIS of test holes drilled on the 23,000-acre ranch of O. J. Jones near Midland, Tex., geologists estimate that the tract is underlaid with a bed of potash aggregating more than 57,000,000 tons. Mr. Jones has leased the potash rights of part of the ranch to Texas Potash Corp. of Dallas, Tex.

New Machinery and Equipment

Announces New Pump

THE MORRIS MACHINE WORKS of Baldwinsville, N. Y., announces that it has supplemented its line of standard, medium duty, and heavy duty centrifugal dredging pumps with a new pump of



Impeller assembly designed for adjustment

simpler construction, known as Type L sand pump. This unit has been developed as an inexpensive but rugged and trouble-proof pump for handling sand, silt and other abrasive materials.

Features of this new pump are that the shell, impeller and suction disc are heavily proportioned and are made of hard semi-steel containing admixtures of nickel for resistance to wear and abrasion; the impeller assembly is designed for adjustments to take up wear; and pump parts which may require renewal are designed to be inexpensive and quickly replaced.

To eliminate vibration a rigid connection between the casing and the frame, and an extra-large forged steel shaft supported in a double enclosed bearing, consisting of two heavy duty steady bearings with a roller thrust bearing between, have been provided.

These pumps are built in sizes from 4- to 12-in. and for either belt drive or for direct connection to driver.

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Announces Improvements in Scale

THE KRON CO., Bridgeport, Conn. (formerly American Kron Scale Co.), announces improvements to its line of industrial scales, both in appearance and in operating mechanism.

Over 48 bearing points have been eliminated in the dial mechanism, the manufacturer states, and the six remaining bearing points are of specially designed anti-friction type. These pivot points are high carbon chrome steel ball bearings, and are sealed in a dustproof housing.

The sector has been constructed to offset vibration that may be present in the building in which the scale is located. This enables the pointer to remain steady at the proper weight, the manufacturer states. There is but one point of adjustment on this scale.

The more important features claimed for this scale are that it insures a compact, rigid construction capable of high over loads, that it eliminates all wear at pivot points, and that it increases the accuracy of results under all operating conditions.

•

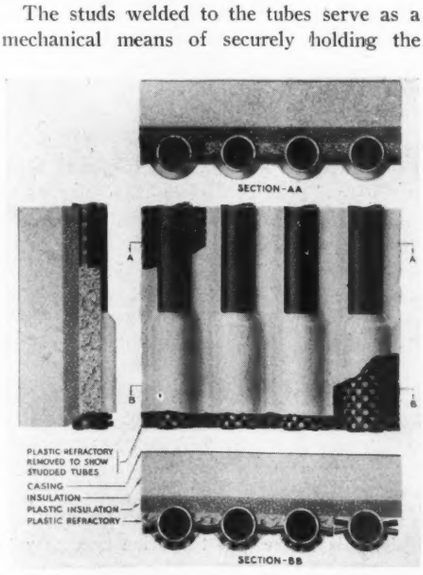
Development in Furnaces

THE DEVELOPMENT of a new water-cooled furnace wall construction, designated as the Bailey "stud tube wall," is announced by the Babcock and Wilcox Co., New York, N. Y. With the stud tube construction, it is said, results fundamentally the same as those secured from the Bailey block covered wall may be attained from certain applications with a lower investment.

A detail arrangement of the stud tubes for a Bailey furnace wall is shown in an accompanying illustration.

The upper portion of the wall as illustrated, in which the tubes are left exposed, represents the construction used in the cooler zones. Insulation held in place by a casing is mounted on the back of the stud tubes.

The studs welded to the tubes serve as a mechanical means of securely holding the refractory and slag coating to the tubes, and as conductors of heat from the wall coating into the water-cooling tubes.



Welds studs to boiler tubes

With Bailey stud tube construction, it is possible to vary the form and character of the wall surface to meet safety, service and combustion requirements for any kind of fuel being burned. The tubes can be bent to any desirable radius to form arches, openings for burners, access and observation doors and form bends or other curved wall surfaces.

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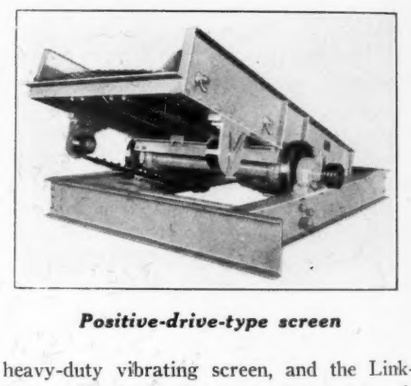
Heavy-Duty Vibrating Screens

TWO NEW TYPES of vibrating screens have just been announced by Link-Belt Co., Philadelphia, Penn. These screens are known as the Link-Belt positive-drive-type,



Positive-drive-type screen

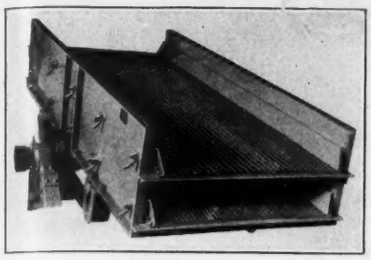
heavy-duty vibrating screen, and the Link-Belt unbalanced-pulley-type, heavy-duty vibrating screen, each made with single and multiple decks.

These two additions to the Link-Belt line of vibrating screens are said to fill needs where large screen openings are required and heavy capacities must be handled.

The positive-drive-type screen can be furnished to provide any given fixed amplitude, with shaft speeds to suit. Any given amplitude will cover a wide range of screening surface openings, the manufacturer states. The angle of the screen inclination, the speed of operation and the direction of the rotation all are changeable at any time to suit the kind, size and condition of material to be screened.

In changing screens only the screen cloths need to be removed. Cantilever leaf springs serve to maintain the screen box at a constant angle. Oversize self-aligning spherical roller bearings are used.

The unbalanced-pulley-type, heavy-duty screen is designed for high speed work where the material is of a sticky nature, and on close-sizing problems where the screen openings are not large, the manufacturer states.



Showing accessibility of screen cloths

The total movement, or amplitude, of the screen can be varied by the user, from zero to about ¼-in., by changing the counterweights in the weight containers.

The weight of the screen box rests on the cantilever leaf springs and responds to the reactions therefrom. The bearings, the method of applying screen cloth, and the cantilever leaf spring design are the same as on the positive-drive-type of screen, above referred to.

●

Dragline on Caterpillar Mounting

THE NEW 45-dragline announced by the Bucyrus-Erie Co., South Milwaukee, Wis., is a special machine for dragline work. One of its outstanding features is the long, tapered caterpillar-type mounting which, the manufacturer states, enables it to work on and cross soft ground easily and without nosing in. These cats are 19 ft. 6 in. long and in design follow closely the type used on the Class 9½ dragline. The new mounting is said to give low ground pressures, to have high clearance under the frame, and to propel easily.

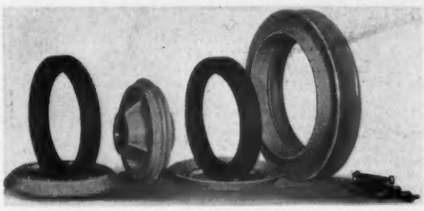
The 45-B may be equipped with a 2 to 2¼-yd. bucket and 50-ft. boom or a 1¼ to 1½-yd. bucket on a 65-ft. boom; booms may be had up to 80 ft. long. It is equipped with a 155-hp., six-cylinder engine and ratings show high speed and line pulls. The boom is said to be of strong but light-weight design and is built of alloy steel. The machine steers like a tractor, through clutches controlled by a lever at the operator's side, it makes sharp or gradual turns with cab in any position.

This new dragline has large fairlead sheaves that cut down rope wear. It is not convertible to a shovel though it may readily be used for clamshell or crane service. It is only necessary to remove boom and A-frame to ship on most roads.

●

Rubber Insulated Sheaves

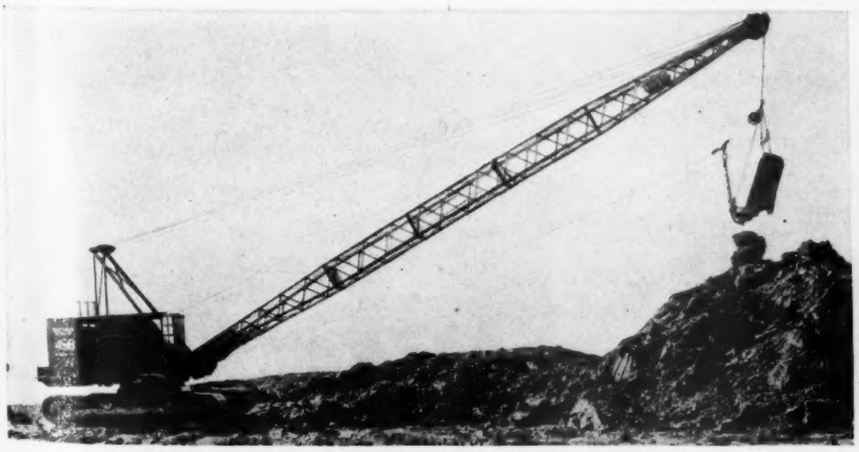
THE ARMSTRONG Manufacturing Co., Waterloo, Ia., announces improvements to its all-steel drill to reduce vibration. In addition to a rubber cushioned shock absorber in the derrick head, the spudding sheave on the beam is now insulated with rubber. The sheave on the heel shaft also has a rubber cushion.



Parts of rubber insulated sheave

These sheaves are constructed with a cast iron inner hub fitted with a bronze bushed bearing. The outer ring which has the cable groove is a steel casting with the cable groove ground to fit the cable. The two solid rubber rings are held in position by two steel flanges with twelve ⅝-in. diam. bolts. The outer rim is separated from the hub by a ¾-in. gap which prevents metallic contact as the outer rim floats on the rubber.

These sheaves are standard equipment on all Armstrong No. 29 blast hole drills and can be furnished on any No. 29 now in the field. The manufacturer states that drills so equipped, and with steel drilling cable are now carrying as much as 2600 lb. of tools with no appreciable jar on the machine.



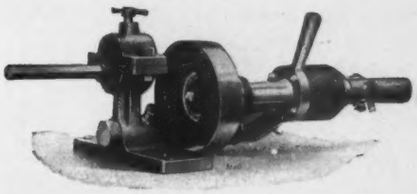
Long, tapered caterpillar-type mounting a feature

Besides providing vibrationless motion of the drilling tools the manufacturer claims this development increases drilling progress of its equipment.

●

Shank Grinder

THE INGERSOLL-RAND CO., New York, N. Y., announces the 4K shank grinder, a tool for facing the striking ends of drill steel shanks, rock drill and paving breaker pistons and anvil blocks.



Grinding wheel passes back and forth

The machine consists of a "Multi-Vane" air grinder mounted in a frame so as to allow the grinding wheel to be passed back and forth by means of a handle. The grinder mounting is fitted with a wing nut adjustment working under spring tension for feeding the wheel up against the face being ground.

The steel or piston is held in a self-centering V-block clamp incorporated in the frame. A countersinking bit is located in the center of the grinding wheel for removing the burr from the hole in hollow drill steel. The complete machine can be bolted securely to the top of a work bench or other suitable location.

It is claimed the 4K grinder insures the uniform and correct dressing of striking faces and eliminates round drill steel shank ends and cupped pistons. Its use results in better performance of drills and paving breakers and reduces maintenance and replacement costs, the manufacturer states.

●

Erratum

IN DESCRIBING the Patterson "Gyrocentric" crusher, manufactured by the Patterson Foundry and Machine Co., East Liverpool, Ohio, in ROCK PRODUCTS, March 26, it was stated that this was an improved model of a crusher formerly manufactured by the James H. Beans Foundry Co. The manufacturer advises that this crusher is not the crusher formerly manufactured by the Beans company nor is it an improved design of the Ohio crusher.

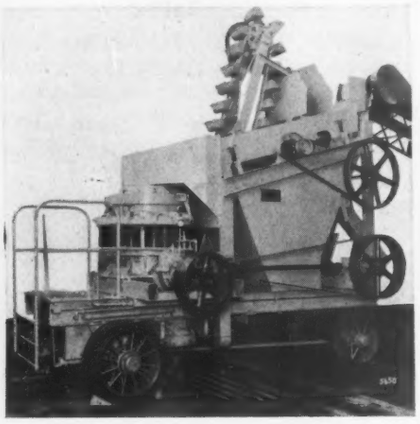
●

Pump Standards

THE FIRST REVISION of contractors pump standards adopted by the Contractors Pump Manufacturers Bureau on January 12 and approved by the Associated General Contractors of America on January 22 has been published and distributed to those interested in it.

For Recrushing and Rescreening

A NEW portable crushing-screening-loading plant which rock products plants may find suitable for recrushing and rescreening work is announced by the Smith Engineering Works, Milwaukee, Wis. It is equipped with a vibrating screen and may be furnished interchangeably with a No. 2 cone crusher or a Telsmith-Wheeling jaw crusher in any one of four sizes.



Crushes and screens

All of these machines are equipped with: Telsmith standard plate feeder which is adjustable to function at different capacities; Telsmith standard vibrating screen, two Telsmith conveyors, and either 10 or 20 cu. yd. portable steel bin, or when preferred, a short conveyor for loading direct to trucks.

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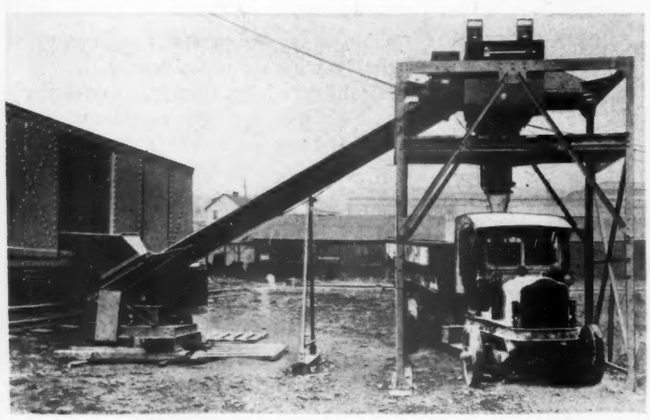
Bulk Cement Handling Equipment

EQUIPMENT for handling bulk cement which may have application at some ready mixed concrete plants is announced by the Blaw-Knox Co., Pittsburgh, Penn.

With this equipment no bin is required. The hinged car hopper is adjustable to car height for the use of either buggies or scoop shovels. A 4-cylinder engine operates the enclosed screw conveyor, which loads a 1000-lb. double-beam cement weighing batcher. This batcher is equipped with springless dial indicators which show when the batcher is full or empty.

A canvas chute controls the discharge into truck compartments. The entire plant is easily portable.



Batches bulk cement direct from car

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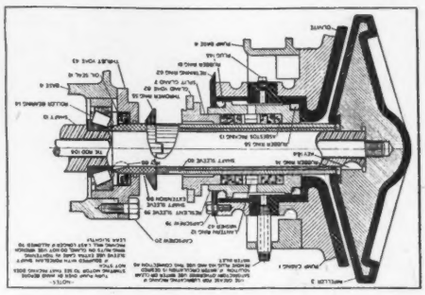
Acid Pump

THE "Olivite," a pump for handling acids and corrosive solutions, is manufactured by Oliver United Filters, Inc., New York, N. Y.

The casing and impeller are covered with Olivite, an acid resisting material that is bonded to the iron of the casing and impeller. The manufacturer states it will stand high temperatures and resist hard knocks without breakage.



Acid pump stands high temperatures

It is equipped with roller bearings and the stuffing box rides on rubber rings that absorb vibrations. It is made for belt or motor drive or with the pump and motor built as a unit.

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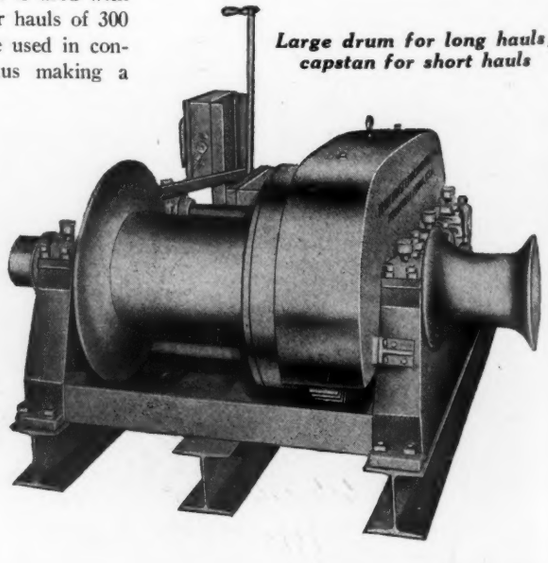
Car Puller Equipment

A NEW DRUM and capstan car puller is announced by the Fridy Hoist and Machinery Co., Mountville, Penn., superseding its former model.

On the new model the large drum which operates free on the main shaft is used with steel cable for long hauls. For hauls of 300 ft. and less the capstan can be used in connection with manila rope, thus making a combination of both types of car pullers for handling heavy hauls at slow rope speeds. These are furnished, as shown in an accompanying illustration, with 10-, 15- and 20-hp. motors.

Features claimed for this car puller are: Asbestos lined double V-shape friction clutch operated by an improved type screw-thrust, said to assure a positive grip and release of the drum; brake band on the drum has a wide face; triple spur gear reduction is totally enclosed; rigid and substantial construction; and conveniently located controls.

Large drum for long hauls; capstan for short hauls



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Bronze Welding Rod

A NEW WELDING ROD, known as "Oxweld No. 25 M" bronze welding rod, has been announced by the Linde Air Products Co., New York, N. Y. Because of its special characteristics this manganese bronze rod is suitable for use in the rebuilding of wear-resisting surfaces such as piston rings or cylinder walls. Besides producing weld metal with wear-resisting qualities, this rod is also non-fuming and free-flowing, the manufacturer states.

According to the manufacturer, one of the features of Oxweld No. 25 M bronze welding rod is the hardness of the resulting weld; also that welds made with it have consistently shown a hardness of 96 Brinell. It is supplied in three sizes: ⅛ in., $\frac{3}{16}$ in. and ¼ in.

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Preventing Blasting Troubles

A BOOKLET, "Prevention of Blasting Trouble Through the Proper Care and Use of Safety Fuse," has been issued by the Ensign-Bickford Co., Simsbury, Conn.

Subjects discussed include transportation and storage, storage of fuse primers, making fuse primers, waterproofing the crimp, making primer cartridge, charging holes, common causes of premature and delayed shots, and misfires.

Elects New President

COL. J. S. ERVIN, long a sales executive in the steel industry and a former army officer, has been elected president of the Mackintosh-Hemphill Co., Pittsburgh, Penn., one of the oldest units in the steel business and constructor of much crushing machinery equipment used in the rock products industries. Colonel Ervin was also made a director of the company.

J. S. Ervin

A number of other changes in the executive personnel were announced. F. Hughes Moyer was elected vice-president of the company and senior engineering officer.

H. E. Field, former president of the Wheeling Mold & Foundry Co. and former vice-president of the Continental Roll and Steel Foundry Co., was also elected a vice-president.

F. C. T. Daniels was elected chief metallurgist and chief research engineer. Other officers elected by the board include: Donald H. Baum, secretary; W. C. Rice, treasurer; C. Howard Paul, assistant treasurer; and J. R. Patterson, divisional sales manager.

The Mackintosh-Hemphill Co. was founded 129 years ago and has built almost a thousand rolling mills for use in all parts of the world. The company built the first foundry and the first locomotive west of the Alleghenies and produced the first chilled roll. It designed and built the entire original Homestead Steel Works for Andrew Carnegie and sold it to him on "the installment plan." One of its presidents invented many of the manipulating devices used in modern rolling mills.

Considers Permit for Crusher

HEARING will be held April 11 on the petition of John D. Gregg to establish and operate a sand and gravel pit and rock crusher on 13 acres of wash land adjacent to the proposed county flood control spreading ground at Arrow highway and Peck road, south of Duarte, Calif.

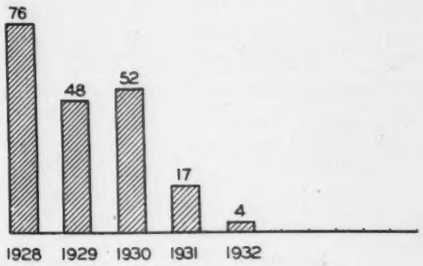
Mr. Gregg's petition, filed January 5, has met opposition of owners of many nearby ranches and the Duarte Chamber of Commerce.—*Pomona* (Calif.) *Bulletin.*

New Use for Sand

A MANUFACTURER of abrasive machinery is making a midget sand blast machine which is being sold California egg ranchers to make their eggs bright. Blast sand producers take notice!

February Accidents

THE FEBRUARY accident record of the Portland Cement Association was the lowest in the history of that organization, reflecting, perhaps, a reduced scale of operations as well as the continued down-hill trend in the number of accidents per man-hour worked. During the entire month 130 plants reported only four lost-time accidents, two of which involved permanent disabilities. No fatal accidents were reported.



Five year February record

Report of Accidents

Burning Department—A workman was engaged in driving a wedge under a bearing ring on top of kiln. Hammer glanced off of wedge and caught coal plant operator's left thumb between it and rim of bearing ring, completely severing thumb at distal joint.

Power Department—Power house operator attempting to tighten packing gland on steam valve, neglected to close valves. Compressor automatically started crushing finger between air valve road connecting link and steam chest. Injuries necessitated amputation of first finger at third joint.

Burning Department—Millwright was placing gudgeon bolts in kiln feed screw, turning gear to align holds. Floor plates were left off and injured stepped in opening, striking side against hopper. Injuries consisted of a fracture of a rib.

Yard Department—Laborer was unloading railroad ties from box car. As he was in the act of throwing ties toward door of car tongs did not let loose, causing injured to be jerked. He was operated on for hernia two days subsequent to this mishap.

To Build Rock Asphalt Crushing Plant

AS A PART of their program for the development of a large deposit of rock asphalt situated near Santa Rosa, N. M., the owners, A. R. Hebenstreit of Albuquerque, N. M., and V. K. Jones of Denver, Colo., are constructing a rock crushing plant to cost $300,000. The asphalt rock material is located about 7 ft. below the surface, has an average thickness of 70 ft. and covers an area 8 mi. by 3 mi., according to explorations that have been made.

Winthrop Sargent

WINTHROP SARGENT, 79, industrialist, genealogist and member of a distinguished New England family, died recently in Haverford, Penn.

After receiving his education in Philadelphia, Mr. Sargent spent 14 years at the Altoona plant of the Pennsylvania railroad. He helped organize the Pennsylvania Glass sand Co. and the Patterson Sargent Paint Co. of Cleveland. He was a director of the De Long Hook and Eye Co., the Giant Portland Cement Co., the Avonmore Coal and Coke Co., and of other concerns.

"Early Sargents of New England" is the subject of one of Mr. Sargent's genealogical works.—*Boston* (Mass.) *Transcript.*

Edison to Remodel Old Lime Plant into Cement Plant

THE Edison Cement Corp., West Orange, N. J., has purchased the former plant of Building Materials Corp., Raritan Township, N. J., for $177,500, it is reported. The plant will be remodeled for a new cement mill to cost about $500,000 with machinery. The operating company will be known as the Metropolitan Cement Corp.

OWNERSHIP OF ROCK PRODUCTS

Statement of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of ROCK PRODUCTS, published every second Saturday at 542 South Dearborn street, Chicago, Ill., for April 1, 1932.

State of Illinois, County of Cook, ss.

Before me, a notary public in and for the state and county aforesaid, personally appeared Nathan C. Rockwood, who, having been duly sworn according to law, deposes and says that he is the business manager of ROCK PRODUCTS, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Tradepress Publishing Corp.; Editor, Nathan C. Rockwood; Managing Editor, None; Business Manager, Nathan C. Rockwood.

2. That the owner is Tradepress Publishing Corp., Chicago, Ill., and that the stockholders holding 1% or more of the total amount of stock are: W. D. Callender Estate, Nathan C. Rockwood, both of 542 South Dearborn street, Chicago, Ill.

3. That there are no bondholders, mortgagees, or other security holders owning or holding 1% or more of total amount of bonds, mortgages or other securities.

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest, direct or indirect, in the said stock, bonds, or other securities, than as so stated by him.

NATHAN C. ROCKWOOD,
Business Manager.

Sworn to and subscribed before me this 21st day of March, 1932.

(SEAL) JOSEPH W. HERMANN.

(My commision expires October 21, 1932.)

News of All the Industry

Incorporations

O. O. Ogden Gravel Co., Inc., Baton Rouge, La., $2000.

John Haeusser Concrete Products Co., Buffalo, N. Y., $100,000. O. C. Joslin, Buffalo.

Ripplemead Lime Co., Inc., Ripplemead, Va., capital $15,000. Bernard Mason.

Britton Crushed Stone Corp., Rochester, N. Y., changed name to Britton Stone and Supply Corp.

Kingsland Granite Co., Llano, Tex., $35,000. W. H. Johnson, C. H. Owens and C. N. Avery.

Lanwehr Stone Co., Ottawa, Ohio, $50,000. Henry Lanwehr, Elizabeth Lanwehr and Victor W. Lanwehr.

Southern Sand and Gravel Co., Muskogee, Okla., $10,000. H. T. Ballantine, R. A. Murray and D. G. Heflin, Jr.

Grand River Pure Lime Co., Miami, Okla., $25,000. T. B. Walker, Miami, and Ellsworth Moore, Fairland, Okla.

Spillar Cement Co., Cleveland, Ohio, $3000. Frank J. Spillar, Mary Spillar, Adolph Kroutil and J. A. Artl, 102 Engineers Bldg., Cleveland, Ohio.

Universal Art Stone Co., Oklahoma City, Okla., $100,000. Frank L. Weireter, Oklahoma City; Robert L. Lewis, Edmund, Okla., and E. P. Navarro, Norman, Okla.

Illinois Limestone and Fertilizer Co., Gladstone, Ill., changed name to Illinois Marble and Limestone Co. and increased capital stock to $200,000. Jacob Ringold, president.

Boston Plaster Co., Inc., Boston, Mass., $50,000, consisting of 500 shares at $100 each. President, Edwin T. Bailey; treasurer, John M. Erskine, 172 Proctor Ave., Revere, Mass., and Alfred Ausiello.

Whittemore Sand and Gravel Co., Boston, Mass., 2000 common shares of no par value. President, Alfred I. Merigold; treasurer, Robert Earl Eichler, 21 Lyman St., Waltham, Mass., and Richard S. McSorley.

L. Suzio Trap Rock Co., Southwick, Mass., $200,000, consisting of 2000 shares at $100 each. President, Leonard Suzio; vice-president, William J. Smith; treasurer, William S. Clark, 232 Curtis St., Meriden, Conn.

Quarries

Tressel Stone Co., Ada, Ohio, has made improvements and repairs to its plant.

San Antonio Rock Products Co., Pomona, Calif., has started operation of its new plant there.

Olentangy Stone Co., Delaware, Ohio, announces it will work two shifts to supply material on contracts recently obtained.

Todd Land Corp., Webb City, Mo., is reported to be developing a limestone quarry to produce crushed limestone at Neosho.

Gardner, Kan. The county commissioners have obtained a new quarry site and will move their crusher to the new location.

F. B. Weir and son, Burbank, Calif., have petitioned the city council for permission to construct a $2000 rock crushing plant there.

Binghamton, N. Y. The Lackawanna railroad recently purchased 120.000 tons of crushed stone ballast from quarries which it serves.

C. H. Bibbee, manager, Russell Coal Co., Clarksburg, W. Va., is reported to have completed preliminary plans for construction of a crushed stone plant at Industrial.

Salem Lime and Stone Co., Inc., Salem, Ind., announces it has opened a general sales office in Louisville, Ky., which will be in charge of A. T. Shrum, general sales manager.

Central Kansas Quarries Co., Ottawa, Kan., announces purchase of rock crusher plant and equipment of Monarch Material Co. which it will continue to operate under the name and management of Central Kansas Quarries Co. E. G. Melchert, former owner of the Monarch company, will remain with the new organization.

Sand and Gravel

C. F. Freed and son, New Paris, Ohio, have installed a new crusher at their gravel pit.

David Marcoe has sold his interest in the Burt County Gravel Co., Tekamah, Neb., to Duane S. Tomlinson.

Chicago Gravel Co., Chicago, Ill., suffered damage to its roundhouse and equipment from fire at its Joliet, Ill., plant recently.

Pioneer Sand and Gravel Co., Seattle, Wash., has been appointed exclusive distributor in the state for Philip Carey Co. products.

Old Dominion Sand and Gravel Co., Inc., Richmond, Va., announces R. J. Rundle as succeeding the late Herbert Wingfield as manager.

Mississippi Clay Co. has offered to furnish free gravel from its Charleston, Miss., plant in order to demonstrate its qualities as a road surfacing material.

Fond du Lac, Wis. Crushing and screening equipment recently purchased from Oneida county is being installed in a gravel pit here by the local county commission.

A. W. Martin, Eugene, Ore., has taken over the management of the Glenwood Sand and Gravel Co., located between Eugene and Springfield. Extensive improvements are planned.

Pittsburgh, Penn. Sand and gravel operations on the Allegheny river will be resumed this year on a larger scale, since slack water now exists for a distance of 60 mi., it is reported. The Hudson Sand Co. has purchased dredge No. 6 from the McClain Sand Co. and six barges for operating in the upper pools of the Allegheny river.

Cement

Lone Star Cement Co., Kansas, was host at its Bonner Springs plant to a group of chemical engineering students who visited there.

Huron Portland Cement Co., Detroit, Mich., announces that its business in Wisconsin territory will be handled from the general offices in the future, although a district sales office will be maintained in Milwaukee.

Lone Star Cement Co., Virginia, has requested permission to dredge approximately 25 acres in Nansemond river near its plant at Holladay Point, Va. Approximately 900,000 cu. yd. of material to be used for commercial purposes is included.

National Cement Co. announces its sales office will be moved to combine with the general office at Broadway and Cherrier St., Montreal-East, Que., Can. It is reported that application has been made to surrender the charter of this company, which is a subsidiary of Canada Cement Co.

Superior Portland Cement, Inc., Seattle, Wash., announces the Pacific Coast Cement Co. plant, which it has under lease, will reopen in April; the Concrete plant has resumed operation; the company's quarries near View Cove, Alaska, will open May 1; and that the steamship *Diamond Cement* will resume operation at the same time.

Gypsum

United States Gypsum Co. was host recently to a group of dealers and contractors in the south Oklahoma territory at its plant at Southard. The company is starting operation of its boats which have been docked at New Brighton during the winter. The *Gypsum Empress* will be engaged in hauling rock from its deposit in Nova Scotia to the New Brighton plant.

Cement Products

J. C. Calhoun Mfg. Co. has established a concrete tile plant at 5918 Katy St., Houston, Tex. J. C. Calhoun, Sr., is president and general manager.

C. L. Briggs, Lake Charles, La., **John L. Barry**, Lafayette, La., and **W. B. Landes**, Beaumont, Tex., are planning to organize a company to build a concrete pipe factory at Lafayette, La. Cost is estimated at about $15,000.

Lime

Kenova Basic Products Co., Kenova, W. Va., to promote the use of agricultural limestone, is offering three prizes to farmers for the best acre of alfalfa grown during 1932.

Holmes Lime and Cement Co., Felton, Calif., announces F. G. Holdinghausen of Los Angeles has been appointed superintendent to replace George N. Ley who resigned recently. Mr. Holdinghausen has been general sales manager of the Mission Lime and Cement Co. for the past six years and this position will be filled by R. J. Schirm of San Francisco. New equipment has been ordered for the Holmes company plant.

Silica

New Method Silica Co., Rogers, Ark., has leased about 100 acres of silica land near there and plans installation of equipment to cost over $45,000 complete.

Miscellaneous Rock Products

Elyria Magnesium Products Co., Elyria, Ohio, has had Dell Boylan appointed receiver.

Asbestos-Talc Products Co., Burlington, Wash., is defendant in a suit asking receivership, it is reported. C. C. Clauson of Seattle has filed suit in this action.

C. B. Hayes, president, California Agricultural Potassium Phosphate Co., recently announced his company at Paris, Ida., expects to start shipping crude phosphate to Los Angeles soon.

Sylvanus and Co., headed by E. C. Sylvanus, has been organized to develop onyx deposits in southwestern Wisconsin. A lease on known deposits has been signed, it is reported.

Moss Chemical Co., Dalton, Ga., is a reorganization of a company formerly located in Atlanta which is developing talc deposits in Murray county. A new plant is being completed.

Asbestos Corp., Montreal, Que., Can., in its reorganization plan, is reported to have obtained a deposit of sufficient bonds and stocks of the company to carry out the proposed reorganization it plans.

Newport Abrasive Stone Co., Newport, Ark., was recently established and has elected the following officers: W. H. Howze, president; Lain McDougald, vice-president, and R. L. Bullock, secretary and treasurer.

Personals

Eugene Enloe, president, Idaho Portland Cement Co., Pocatello, Ida., and who is interested in a number of other enterprises there, has been elected president of the Washington Trust Co., Spokane, Wash.

Obituaries

George Nicholson, vice-president of the Vulcan Iron Works, died at Wilkes-Barre, Penn., on March 15.

General Christopher O'Neill, 76, for many years associated with the Lehigh Portland Cement Co., died March 23 at his home in Allentown, Penn.

Thomas F. Collins, 63, general manager, Calavera Rock Co., Carlsbad, Calif., died while at work on March 11. Mr. Collins organized the Calavera Rock Co. four years ago.

Thomas M. Bradley, 80, died at his home in Birmingham, Ala., on March 15. Among his various business activities he organized the Southern Cement Co. in North Birmingham.

Fred Hartung, 74, who operated a stone quarry in Wauwatosa, Wis., for 20 years, died March 17. Mr. Hartung spent much time in political activities in addition to his interest in the quarry.

William L. Ware, secretary and treasurer of the Van Camp Sand and Gravel Co., Cincinnati, Ohio, died in Cincinnati on March 19. He has been associated with the Van Camp company for the past three years.

T. J. Schott, 53, president of the Wausau Sand and Gravel Co., Wausau, Wis., died at his home, March 19. Mr. Schott was also vice-president of the Wausau Concrete Co. and one of the organizers of the Wausau Iron Works.

You Want the Low-Cost Sand Washer

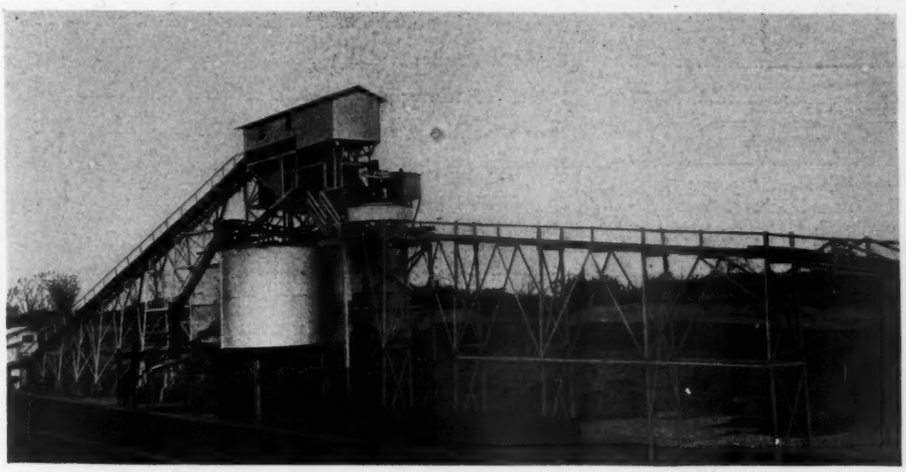
—*Then You Want the* DORRCO

Many prospective purchasers of sand-washing equipment have thought of Dorrco Sand Washers as high priced machines. "We like the machine fine" they have said, "but we can't afford it." They were surprised when we showed them that the Dorrco Sand Washer is the cheapest "buy" on the market.

Figure to write the cost of the machine off in five years. The price of a Dorrco Sand Washer to handle 50 tons of sand per hour is about $1400. For the next five years repair and upkeep costs can be conservatively put at $75, making a total of $1475, or $295.00 per year. Can you figure any other sand washer of equal capacity as being anywhere near as economical? Not when you total up first cost, repairs, time lost by your men, trucks or scows while repairs are being made, business lost through production tie-up and rejected shipments.

We have actual records of Dorrco Sand Washers operating over six seasons and always producing sand to meet specifications and of going through four straight seasons of operation without one cent being laid out for repairs.

When you want the most dependable, ***low-cost*** washing equipment you can't do better than the Dorrco Sand Washer.



Four sizes, capacities 20-400 tons per hour

DORRCO

THE DORR COMPANY, INC.

ENGINEERS

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